FAA Aviation News

JANUARY/FEBRUARY 1996

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... MORE DEICING TIPS page

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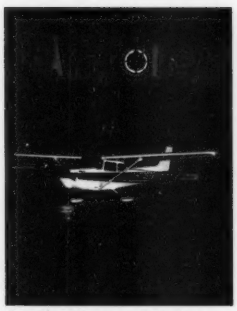

On the Cover: *A "clean aircraft" is important for night, winter flying. Page 1 Photo by David Clemmer*

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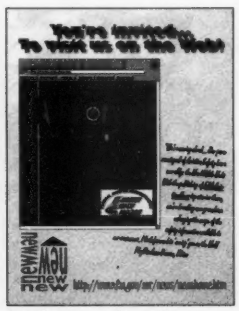
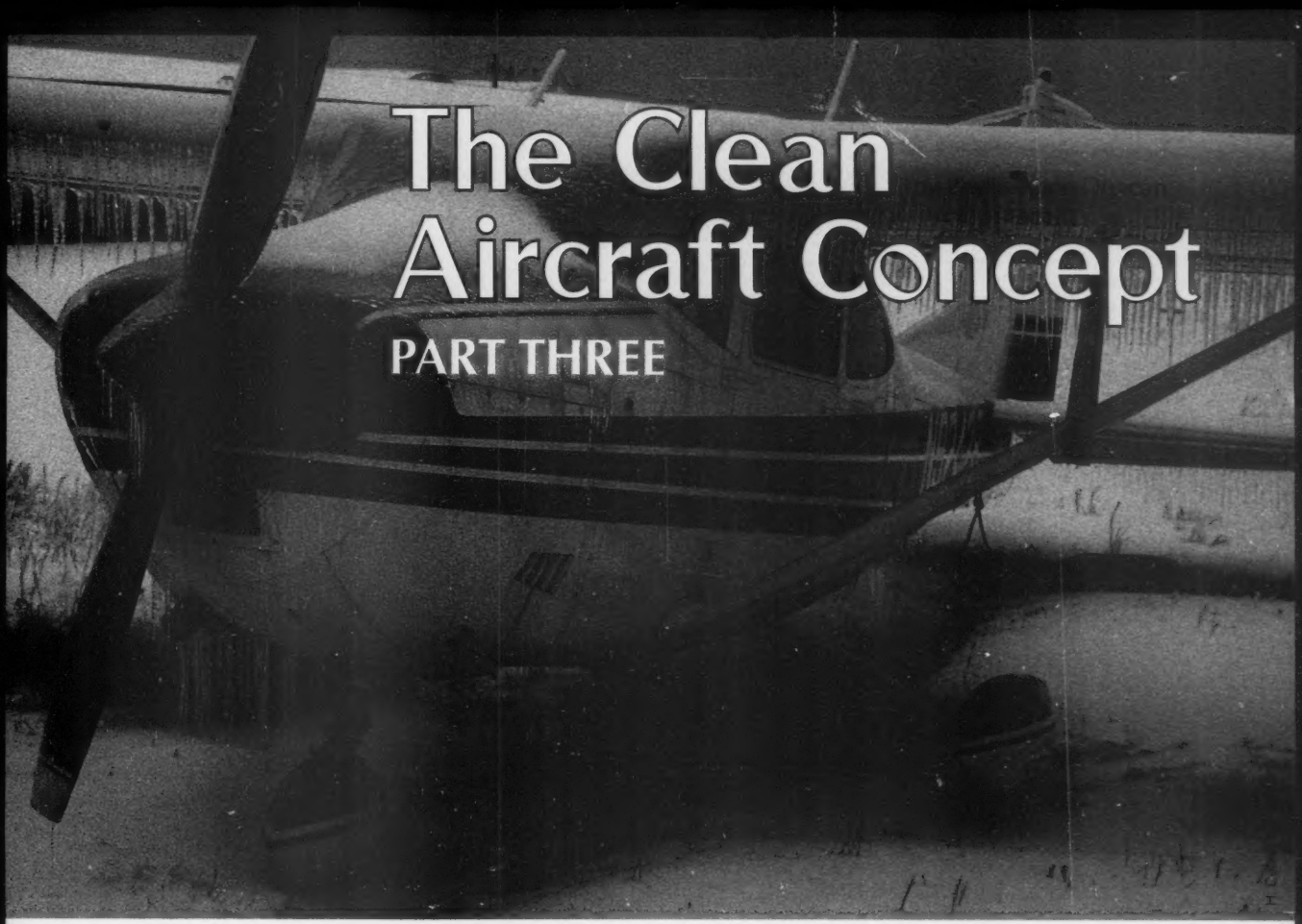


Look "us up" on the WWW. Inside Back Cover.



The Clean Aircraft Concept

PART THREE

In Part One of this article (October 1995) we discussed how ground operations in winter weather conditions can foster frozen contamination on critical aircraft aerodynamic and control surfaces. Part Two (November/December 1995) contained information on freezing point depressant (FPD) fluids used in aircraft deicing/anti-icing. All this information is to assist the pilot of small airplanes in fulfilling his or her PIC responsibilities for a safe flight by introducing the clean aircraft concept—that it is unsafe and even deadly to attempt takeoff with ice, snow, or frost adhering to critical parts of the aircraft. One way for a pilot to assure the aircraft is clean is to have it deiced then anti-iced.

Procedures for aircraft ground deicing and anti-icing depend on the type of accumulation on the surfaces, on the components of the aircraft, and the type of aircraft. Consequently, procedures vary for these reasons and because of the different types of FPD fluids. Regardless of the different procedures, pilots of a particular aircraft must become familiar with the procedures recommended by the manufacturer of the aircraft. These procedures can be found in the aircraft's flight manual (AFM), maintenance manual, or aircraft service manual. Manufacturer procedures take into account procedures recommended by the FPD fluid manufacturer and, because fluids can seep into engine compartments, engine manufacturers as well.

Why does the pilot need to become familiar with these procedures and manufacturer recommendations? Because the pilot has the ultimate responsibility for the safety of the flight and will be the one making the call on deicing/anti-icing. It is important, then, that the pilot not opt for whatever FPD fluid or deicing/anti-icing procedure an airport has to offer. The wrong fluid or the wrong equipment can damage the aircraft. FAA offers this caution:

If improperly used, some deicing/anti-icing fluids can cause undesirable and potentially dangerous changes in aircraft performance, stability, and control. Also, the fluid may not remain effective for the expected time. If the pilot is not familiar with the recommended procedures for his or her particular aircraft, the only deicing option may be placing the aircraft in a heated hanger; without knowledge of the appropriate, manufacturer-recommended procedures, the pilot may have no deicing options. Then, taxiing through airport conditions conducive to frozen contamination formation may make it unsafe for the aircraft to attempt a takeoff.

THE CLEAN AIR

Deicing and Anti-icing with Fluids

Wings/Airfoils

The main lifting surfaces on an aircraft are the wings, and they must be as free of contamination as possible in order to do their job. Upperwing frost, snow, or ice changes the airflow characteristics over the wing. This reduces lifting capability, increases drag, increases stall speed, and changes pitch moment. Weight increase is actually slight, and the effects of any weight increase are secondary to the effects of surface roughness.

For most aircraft, deicing of the wing begins with the leading edge wingtip and should proceed aft and inboard. This assures that heavy snow, for example, is removed from the outboard surfaces first, eliminating loading pressure outboard that could produce wing stresses. This also helps to assure that ice or snow won't be flushed into balance bays or other cavities.

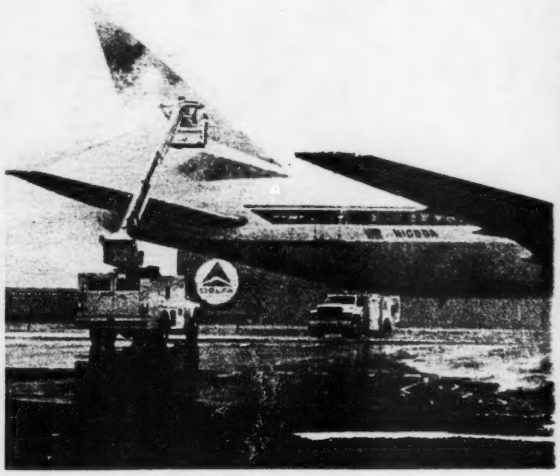
Ice accumulation in flap tracks or control cavities may require removal from the trailing edge forward, as does certain wind or ramp conditions. (Propellers should be static when de-iced, and all blades should be uniformly clean. If not, imbalance could occur at normal operating RPM.)

Leading edge slats and trailing edge flaps should be retracted to avoid ice, snow, or frost accumulation during overnight, outdoor storage. If you've left them extended, however, visually check the surfaces, tracks, hinges, seals, and actuators to determine if they need deicing before retraction.

Remember, however, that the portions of retracted flaps and slats will not receive a protective film of the anti-icing treatment. If you then extend them and operate in conditions conducive to frozen contamination, they may freeze-up. Again, the AFM, the operating manual, or maintenance manual will contain recommended procedures for flaps and slats under these conditions.

Tail

The same cautions for wing deicing procedures go for the tail. The tail also needs close inspection of balance bays between movable and stationary surfaces, as well as areas near balance horns. For some aircraft, if you place the horizontal stabilizer with its leading-edge down, the FPD fluid and contaminants will run off rather than into the balance bays. Other aircraft require that the horizontal stabilizer be leading-edge up during deicing. On yet other aircraft, the elevator needs to be preset.



Also, you need to check balance bays, control cavities, and gap seals to assure they are not blocked to begin with or won't trap any fluid runoff. When frozen contamination collects where surfaces come together (junctures), the contamination must be removed to prevent the seals from freezing. This could impede free movement of the controls.

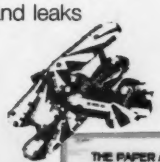
Fuselage

From the top down is how the fuselage should be deiced. If the fuselage is deiced manually instead of by spraying, care must be taken not to damage any protruding equipment—like antennas. If heated fluid is sprayed on the top of the fuselage first, it has the added benefit of warming the skin of the remainder of the aircraft and removing accumulations of frost, snow, or ice as it flows down and off. This run-down is particularly important when deicing windows or windscreens. Heated fluid sprayed directly onto cold windows or windscreens could cause "thermal shock," cracking or crazing the plexiglass or other window material. (Whereas the FPD fluid film should remain on other aircraft surfaces for anti-icing, it should be removed from pilot and copilot windows so visibility won't be impeded.)

Aircraft with aft-mounted or aft side-mounted engines present an extra challenge to deicing. The top-down method helps to keep run-off of ice or slush from collecting in the inlets and from then being ingested when the engine starts up. This is particularly important for turbine engine aircraft.

The nose—where the radome is on most aircraft—should be deiced to keep accumulations of ice or snow from blocking the pilots' view from the cockpit. This compartment may also contain navigation and guidance equipment, and deicing assures proper operation of these sensors. Compartment seals and closures should be checked before deicing, however, to assure that residual fluids do not leak onto sensitive equipment. (Residual fluid should also not trail back onto pilots' windows during taxi or, more importantly, the takeoff run.)

To operate properly cargo and passengers doors should also be deiced and anti-iced; then, the hinges, tracks, and seals should be visually inspected for frozen contamination. Seals can be damaged if the doors are operated with the seals frozen, and leaks can later occur.



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Various instrument probes and orifices on the fuselage can also be damaged when applying FPD fluid. Direct spray into these openings is not appropriate and can result in incorrect instrument readings in the cockpit. They can be protected with covers when fluid is applied—but remember, REMOVE BEFORE FLIGHT.

Fluids—Again!

Some aircraft manufacturers will recommend heated water alone be used for de-icing since FPD fluids may not be compatible with aircraft finishes, seals, etc. If heated water alone is used, you must be especially careful that it does not collect in pockets where it can freeze. It is recommended that heated water alone be used only when the temperature is above 27°F and when the water is heated to about 140°F. This must be followed by a close inspection to assure refreezing has not occurred. There are some deicing/anti-icing fluids, originally developed for large commercial, transport-category aircraft, which can be used on small aircraft, typically those found in FAR Part 135 operations. There is guidance in AC 135-17, "Pilot Guide - Small Aircraft Ground Deicing," for applications of SAE and ISO Type I and II fluids; however, the procedures for deicing and anti-icing using these fluids must have been developed for the aircraft and must be contained in the FAR Part 135 operator's manual or other documentation. There may be no procedures available for light, general aviation aircraft.

Why heat the fluids? Heating increases the deicing effectiveness, but unheated fluid is more effective (i.e., lasts longer) for anti-icing.

One Step or Two?

Deicing and anti-icing with fluids can be a one-step or a two-step process. Predetermined practices, weather conditions, FPD fluid concentration, and available equipment and facilities determine which it will be.

The one-step procedure uses a heated FPD mixture to deice; then, the residual FPD fluid film provides the anti-icing protection—but because the fluid has been heated, the protection is limited. The protection can be enhanced by adding cool fluid or by cooling the heated fluid during deicing. One technique is a final coat of deicing fluid applied in a very fine spray and in an arced trajectory that allows cooling as the spray settles. This also produces a thicker coating with enhanced anti-icing properties. One caution is to assure that the deicing fluid on the aircraft has not crystallized (frozen) before applying the final spray.

The two-step procedure is two separate applications—deicing followed by anti-icing. The aircraft is deiced using hot water or a hot mixture of FPD fluid and water. This is followed by an application of SAE or ISO Type II FPD fluid for anti-icing protection. Again, only fluids approved for the aircraft should be used, and if you don't know which fluids are approved for your aircraft don't subject it to a treatment that might do more harm than good.

Another caution for the two-step technique is ensuring that there has been no freezing of residual fluid between the steps. When using heated water alone for step one, step two has to happen before refreezing occurs—generally within three minutes after the beginning of step one. For large aircraft, the two-step process may have to be repeated area by area.

Remember that SAE and ISO Type II fluids are to be used only on aircraft with rotation speeds higher than 85 knots; consequently, they may not be appropriate for anti-ice protection on smaller aircraft. And, of course, the fluids should not be used unless approved by the aircraft manufacturer. SAE and ISO Type II fluids SHOULD NEVER BE APPLIED to the following areas:

- Pitot heads and angle-of-attack sensors
- Control surface cavities
- Cockpit windows and nose of fuselage
- Lower portion of fuselage beneath the nose (i.e., radome in some air craft)
- Static ports
- Air inlets
- Engines

A diluted traditional North American or SAE Type fluid can be used on some of these areas. However, fluid or water should NEVER enter pitot or static ports, and manufacturers may recommend placing protective covers over them. (Once again, don't forget to REMOVE BEFORE FLIGHT.)

Deicing the Engine Area

FPD fluids ingested in the APU can cause smoke and vapors which can enter the cabin; consequently, only very small amounts of FPD fluids should be used to deice the engine area or APU. Before deicing, inspect engine air intakes for ice and remove any ice before installing plugs or covers. To prevent plugs from freezing to the nacelle,

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lightly coat them with deicing fluid before installing.

Fluid residue on fan or compressor blades reduces engine performance. In some cases, it can cause stall or surge and can increase the possibility of glycol vapors entering the cockpit through the engine bleed air system. Most turbojet and turboprop engine manufacturers require thrust levers to be advanced to an N1 rpm of 70% to 80% during ground operations. This will help prevent ice buildup that reduces thrust, creates dynamic imbalance of the fan or compressor, or allows excessive induction of ice shed from other areas of the aircraft. Be aware of the procedures for your aircraft and comply with them.

Manufacturers of some turboprop aircraft have approved the use of SAE Type II fluids, but pilots must follow specific procedures to keep from blowing the fluid off during high engine operating speeds before takeoff. If you operate the propellers with a flat pitch during engine run-up and by taxiing with minimum thrust and acceleration, you should not blow the protective film off the aircraft. Use of reverse thrust also causes similar problems.

Health Effects

Deicing and anti-icing fluids are powerful chemicals, and you must exercise care to assure that the crew and passengers suffer no ill effects from inadvertent exposure. If the aircraft is deiced/anti-iced during a turnaround with passengers still aboard, turn off all cabin air intakes to prevent FPD fluid vapors from entering the cabin. The most common effect of exposure to these vapors is eye irritation; however, exposure to ethylene glycol vapors in a poorly ventilated area can cause nose and throat irritation, headache, nausea, vomiting, and dizziness.

All glycols irritate upon contact with skin or sclera of the eyes. This irritation's effects are "negligible," but the chemicals' manufacturers recommend avoiding skin contact by wearing protective clothing when deicing.

Both ethylene and propylene glycol are toxic to humans, although moderately so. Abdominal discomfort and pain, dizziness, and effects on the central nervous system and kidneys occur when small amounts are swallowed. Since FPD fluids are diluted with water and other additives, it is unlikely that deicing personnel could accidently ingest a lethal amount—three to four ounces of pure (undiluted) glycol.

Every commercial FPD fluid has a material safety data sheet with detailed information on health effects and safety precautions to be used around the chemical. The safety data sheets are available from the fluid manufacturer, and operators using FPD fluids for deicing/anti-icing should keep this information on file.

Post-Deicing/Anti-icing Checks

After the aircraft has been deiced and/or anti-iced, it is important to assure that this one safety guard hasn't created a problem in another area. As per the aircraft type and the manufacturer's recommendations, check the following areas and equipment for damage and for refreezing:

- Wing leading edges, upper and lower surfaces
- Vertical and horizontal stabilizers, leading edges, upper and ,ower surfaces, side panels
- High-lift devices—leading edge slats and leading or trailing edge flaps
- Propellers
- Spoilers and speed brakes
- All control surfaces and control bal ance bays
- Engine inlets, particle separators, and screens
- Windshields, other windows nec essary for flight crew visibility
- Antennas
- Fuselage
- Exposed devices such as angle-of-attack vanes, pitot-static pressure probes, static ports, temperature probes; if they've been covered during the deicing/anti-icing proce dure, remove the covers are
- Fuel tank and fuel cap vents
- Cooling and APU air intakes, inlets, and exhausts
- Landing gear

Summary and Conclusion (At Last!)

We as PIC are responsible for the safety of flight under all conditions and circumstances. Careful preflight planning—considering all available weather reports and forecasts—as well as a concerted effort to determine the conditions at the airport you are arriving at or departing makes living up to your responsibilities easier. If you opt for deicing and anti-icing, using materials and procedures compatible with your aircraft is a case where better informed is better armed against the assaults of winter weather. ✈

There are a number of FAA Advisory Circulars on the subject of ground deicing/anti-icing for both large and small aircraft. This three part article was based on AC 135-17, "Pilot Guide - Small Aircraft Ground Deicing." It contains, believe it or not, even more detailed information—especially on holdover times—than this article. There is also AC 120-58, "Pilot Guide - Large Aircraft Ground Deicing;" AC 135-16, "Ground Deicing and Anti-icing Training and Checking;" AC 135-9, "FAR Part 135 Icing Limitations;" and AC 20-117, "Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing." All are available free from U.S. Department of Transportation, General Services Section, M-443.2, Washington, DC 20590

HOW TO ACHIEVE A CLEAN AIRCRAFT

- The ultimate responsibility for the safety of a flight rests with the pilot in command.

- FAR Part 125 and 135 operators must complete a pretakeoff contamination check within five minutes before beginning takeoff.

- The fact that the FAR require a "five-minutes-before-takeoff" check does not mean that the aircraft will always be safe for takeoff for a five-minute period or for any other specific period of time. Certain weather or operational conditions can reduce the effectiveness of FPD fluids to one minute or less. Under those conditions, delay takeoff until weather or operational conditions allow but only after an additional contamination check.

- Know the adverse effects of surface roughness from ice, snow, or frost on aircraft performance and flight characteristics.

- Know ground deicing and anti-icing practices and procedures used on your aircraft—whether performed by your company, a contractor, an FBO, or others.

- Do not allow deicing and anti-icing activities until you are familiar with the practices and quality control procedures of the organization providing the service.

- Know the critical areas of your aircraft and ensure that they are properly deiced and anti-iced.

- Be sure to take proper precautions during the deicing process to avoid damage to aircraft components, surfaces, and instrumentation sensors.

- Perform a thorough post-deicing/anti-icing check as part of the deicing/anti-icing process.

- Know the function, capabilities, limitations, and operations of the ice protection systems on your aircraft.

- Be aware that the effective time of FPD deicing or anti-icing treatments can only be estimated; many variables influence holdover times.

- Ensure that deicing/anti-icing is accomplished at the latest possible time before taxiing to the takeoff position.

- If you see any accumulation of ice, snow, or frost on top of deicing or anti-icing fluids, consider them as adhering; don't assume they'll blow off. Don't attempt a takeoff until any frozen contamination has been removed.

- Do not start engines until all ice deposits have been removed. Ice shed from rotating components, including propellers, may damage the aircraft or injure ground personnel.

- Be aware that certain ground operations may recirculate ice crystals, snow, or moisture which can re-freeze on the aircraft.

- Be aware that operating close to other aircraft can mean that ice particles, snow, or moisture can be blown onto critical components on your aircraft. Dry snow can melt and refreeze.

- Do not takeoff if you observe snow or slush splashing onto critical areas of the aircraft—wing leading edges or trailing edge flaps, for example.

- FPD fluids used for ground deicing do not provide—and are not intended to provide—ice protection during flight.

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Adapted from AC 135-17, "Pilot Guide - Small Aircraft Ground Deicing"

FEATURE

FLYING INTO IMC

by Abel Mirabel

There you are on a cross-country flight believing everything is going as planned–or so you think. Up ahead clouds are starting to build, and you notice some isolated heavy showers. Weather conditions are gradually becoming marginal. "No problem," you say to yourself, "I can fly around this weather if I have to."

Whether you realize it or not, you have just made the decision to press on in spite of deteriorating weather. Before you realize it, visual references suddenly disappear, and everything around you turns milky white. Instantly, your body tenses up, and fear sets in. The stage is set for panic and disaster.

Unfortunately, many inexperienced, non-instrument rated pilots find themselves in this situation, and the outcome is often fatal. Inadvertent IMC-related accidents are increasing. Most occur in encounters with clouds at cruise, flying into ground fog, or flight into heavy rain–none of them a good time to realize that you have limited instrument flying skills.

According to the National Transportation Safety Board (NTSB), approximately 25% of all general aviation accidents and nearly 40% of fatal accidents are weather related. They also cite "continued VFR flight into adverse weather/IMC" as the primary cause in many of these accidents.

Inadvertent entry into IMC can result in either flying into mountains or other obstacles or spatial disorientation. Statistics further reveal that spatial disorientation is the number one cause of fatal accidents in general aviation. Did you know that a pilot who gets spatially disoriented has at least a 90% probability of having a fatal accident? Not a pleasant thought for any pilot.

So how may a pilot avoid unplanned flight into IMC? First, develop safe weather minimums for yourself–perhaps higher than what the FAR require. Set conservative ceiling and visibility values and make sure you stick to them. Before flight, obtain a complete weather briefing and be sure you understand the briefing. Your go/no-go decision will depend heavily on this information. Pay particular attention when the briefer states, "VFR flight not recommended." Many pilots have regretted not taking this advice.

In reading through numerous NTSB accident reports, I was amazed at the number of pilots who actually obtained a weather briefing that included adverse weather along their route but who, nevertheless, decided to fly. There were, of course, a number who didn't even bother with a weather briefing or a flight plan.

The fact is that inclement weather is rarely a pitfall for pilots–except when they just keep pressing into it! Attempting to fly in poor flight visibility is inviting disaster for the inexperienced, non-instrument rated pilot. EFAS (Flight Watch) is a good source to update weather when airborne and weather is visible or anticipated, but if you're uncertain of the weather ahead, turn back! Make that 180-degree turn before the visibility gets poor.

But what happens if you suddenly find yourself in a situation of poor visibility? Maintaining aircraft control is the most important factor in recovering from inadvertent IMC. The discipline to transition from visual to instruments is critical! Here is where your instrument training will pay off.

If at cruise altitude, keep your wings level using the attitude indicator, and maintain your altitude. Begin a 180 degree turn as soon as practical. Keep your angle of bank shallow and certainly no more than 30 degrees. This is not the time to practice steep turns. After reaching visual meteorological conditions (VMC), maintain VFR and land at the nearest suitable airport. If unable to reach VMC, keep flying the aircraft and call for help. Resist the temptation to descend and scud run. If you don't remember any ATC frequencies, dial in the emergency frequency 121.5.

Contact with ATC will be critical in separating you from IFR traffic and to your landing safely. The important thing to remember is maintaining control of your aircraft with attitude, heading, power, and airspeed. Make it a point to practice with your instructor basic instrument maneuvers and communications procedures.

The next time you're tempted to push on into adverse weather, think again. Is the risk worth it? Remember, training + practice = proficiency. The confidence received from proficiency will be very beneficial in any emergency situation.

Better yet, make it your personal goal to obtain that instrument rating. ✈

Mr. Mirabal is the Safety Program Manager of the FAA's Caribbean Flight Standards District Office in San Juan, Puerto Rico. This article first appeared in his Aviation Safety Program Newsletter.

In honor of Black History Month, we contrast how African-Americans fared in aviation's infancy to today, first with a FamousFlyers on African-American pilot Bessie Coleman. Following the FamousFlyers article, is a People in Aviation profile of a modern day Bessie Coleman, who ignored the odds and is now a captain for a major U.S. air carrier.—Editor

The Legacy of Bessie Coleman

It was the era of barnstormers, flappers, race riots, and "anything goes." So it is not surprising that one woman had a dream to make something of herself and extend a hand to others of her race. Her name was Bessie Coleman, the first African American to earn an international pilot's license.

It all started in the town of Atlanta, TX about 10 miles west of where the Texas, Louisiana, and Arkansas borders meet. Susan and George Coleman had been married 17 years by the time Bessie was born on January 26, 1892. They would eventually have 13 children of which only nine would live to adulthood. Bessie's father decided to move to Waxahachie, TX to make a better life for his family, thinking that there would be greater opportunities for work in this cotton town.

His expectations were quickly dashed when he found the same color line existed there as well. He announced that it was time for another move—this time to the Oklahoma territory. Even though the five older children had left home, his wife Susan refused to go. She said he could go if he wanted to, but she and the girls would stay in Waxahachie.

It was 1901. Susan was now left with four girls under the age of nine to raise. She would go to work as a cook/housekeeper for a prosperous white family, who would send food and hand-me-down clothes home for the girls. Bessie, the eldest, would take over the mothering of her younger sisters and attend school when she could. Susan encouraged her children to make something of themselves. To this end she taught her children the manners and speech patterns of her white employers. She also knew the importance of education and encouraged her children to attend school whenever it was in session. In this town cotton was king, and school closed for cotton picking. Bessie and her mother and siblings went to pick cotton with the rest of the town.

Although Bessie didn't attend school regularly, she loved books and read everything that came her way. She wanted to go to college but knew her mother couldn't afford to send her. To earn money for the tuition she went to work as a laundress. By 1910 she had enough money to attend the Colored Agricultural and Normal University in Langston, OK. Unfortunately, there was only enough money for one year. With her eyes opened to another world, Bessie wasn't satisfied to stay in Waxahachie after her year at college. By 1915 she was on her way to a new life in Chicago where two of her brothers lived.

Chicago was a far cry from the small Texas town Bessie had been raised, but it seemed to be just what she was looking for. Even for an African American of that era, there were plenty of opportunities in the African American section—most large cities had ghettos of various ethnic groups. In addition to her older brothers, Bessie found a "support network" among the area's black churches, clubs, and social structure.

Bessie enrolled in the Burnham School of Beauty Culture for a course in manicuring. Hairdressing training took longer. Once trained she could also work in barbershops where tips for doing men's nails were better. She enjoyed her new profession and in 1916 won a contest for the best and fastest manicurist in black Chicago. Another advantage of Bessie's job was meeting some of the more influential black men of her day.

Over the years Bessie's name would be linked with several men, but no one knows for certain exactly what these relationships entailed. However, one puzzled even her family when years later they found out that Bessie had married Claude Glenn, a friend of her brother Walter. He was 14 years her

senior and described as a pleasant, quiet, older man, but not wealthy. The strange thing about the marriage was that they never lived together nor did they ever tell anyone about their marriage.

World War I was a turning point in Bessie's life. Her brothers had served in France and came home talking about the lack of racial prejudice there. Although her job brought in good money she couldn't see herself as a manicurist for the rest of her life, and her brother taunted her with tales of French women who had careers and who even flew airplanes. This provided tremendous motivation for Bessie, who became determined to show her brother she could do anything French women could.

In post-World War I America the thought of a woman flying was bad enough, but for a black woman to learn to fly was impossible. None of the local pilots, who were white, were willing to give Bessie lessons. Frustrated, she visited Robert Sengstacke Abbott, editor and publisher of the black newspaper the *Chicago Defender*, to see if he had any suggestions. He had only one—France. Why France? A 1921 article by Dr. Wilberforce Williams, a columnist for the *Chicago Defender* explained why: "In France more than any other country, one finds the privileges of individual freedom and political unity. There is a total absence of racial antagonism."

All these facts were well and good, but when you don't have the money to hop on the next ship and go, a bit more planning comes into it. In Bessie's case she arranged for her sister to take over her job as manicurist and got a better paying job as a chili parlor manager. She also started taking French lessons.

By November of 1920 Bessie was on her way to France. She was eventually accepted by the Ecole d'Aviation des Freres Caudron at Le Crotoy in Somme for a 10 month flight training course. Flying a French Nieuport Type 82, Bessie finished the course three months early and obtained her Federation Aeronautique Internationale (FAI) license on June 15, 1921—the first U.S. woman of any race to do so directly. (Other U.S. women had received their licenses from affiliated FAI clubs.) She returned to Paris for additional training and by mid-September she was on her way home leaving Cherbourg, France, on the S.S. Manchuria. She arrived in New York and by October was back in Chicago with a stunning French wardrobe including dresses, a tailored flying suit, and a leather coat.

Bessie Coleman, who learned to fly in France, in 1921 became the first black woman to be certified by the Federation Aeronautique Internationale, then the world licensing organization for pilots.

Publicity was the lifeline of the early aviators, and air shows were the main means of income. Unfortunately, the public wasn't interested in straight flying, and, even though Bessie now had her pilot's license, local aviators weren't willing to instruct her in aerobatics. She went back to France in February of 1922, since she couldn't get aerobatics instruction in the U.S.

For the next six months Bessie trained in France, met with Anthony Fokker in Holland, and aviated in Germany. Film clips were made of some of her flights, and she used them later in her lecture tours in the U.S. Suddenly, Bessie was news, the first African American to receive a pilot's license. Reporters were at the dock awaiting her arrival in New York. With a bio that cut years from her age (for the next four years she would claim to be 23) and which gave her a more interesting background, Bessie was ready for them. She knew that the press would control her acceptance by the American public and that was necessary if she was to accomplish her goal—a flight school for other blacks.

Immediately after her return to the U.S., Bessie scheduled her first air show. However, the August 27 event at Glenn Curtiss Field, Long Island, was rained out and rescheduled for September 3. Newspaper ads proclaimed that the "wonderful little woman" would do "heart thrilling stunts." The day dawned clear, and Bessie was finally introduced to the American public.

The designation "little woman" shows part of the attitude that Bessie was up against. Doris Rich, in her book on Bessie, said "as an aviator she was a threat to whites who cherished their racial superiority, and as a woman pilot she threatened the ego of black males." Yet, Bessie was a true champion of her race. She refused to appear in any air show that did not allow blacks to attend. Her motto was "No Uncle Tom stuff for me." She was determined to bolster black pride and refused to promote the stereotypical, derogatory image most whites had of blacks.

After seven long years Bessie had achieved her goal. The poor girl from Texas had made something of herself; she was now a Southside celebrity—"Queen Bess, daredevil aviatrix," whose goal was to open a flight school for black aviators.

Bessie's next career step was going to Oakland, CA to offer her services to the Coast Tire and Rubber Company. She dropped advertising leaflets, but Bessie's greatest value was that she was news, and during any interviews she would promote the tire company. After her stint in Oakland and with money in hand she headed south to her next stop, the Rockwell Army Intermediate Depot in Coronado, where surplus military airplanes were stockpiled. For a mere $400, Bessie finally purchased her own airplane—a Curtiss JN-4—but her ownership was short-lived. As soon as her airplane was ready, a February 4 exhibition flight was arranged to celebrate the opening of Palomar Park in Los Angeles where an estimated 10,000 people would gather to see her. However, it was not to be. Twenty-five miles away in Santa Monica Bessie had just taken off and was at 300 feet when the engine stalled and the airplane crashed. Fortunately she was unconscious when she was pulled from the wreckage because her injuries included a broken leg, fractured ribs, multiple cuts around her eyes and chin, and possible internal injuries.

It would be three months before Bessie was released from the hospital. Still unable to fly because she faced a lengthy recuperation period, Bessie gave a series of lectures on aviation to make money. It would be September before she would be scheduled to appear in another air show but not in her own airplane. Hers was a total loss.

In June of 1923 Bessie returned to Chicago. Although two air shows were scheduled for September, neither took place. Bessie was getting a reputation for being unreliable and temperamental, and she went through a series of broken contracts and changed business managers. Air shows became reluctant to book her so finally Bessie decided it was time for "a good long rest." It would be May of 1925 before Bessie would finally succeed in lining up an air show/lecture series in Texas.

On June 19, 1925 Bessie was back in the air thrilling the crowds with her dives, figure-eights, and loop-the-loops. By September Bessie would add parachute jumping to her repertoire. She told the press that her ambition was "to make Uncle Tom's cabin into a hangar by establishing a flying school." While in Dallas she visited the Curtiss Southwestern Airplane and Motor Company and selected another JN-4 with an OX-5 engine. The only problem was that they wanted cash on the line which Bessie didn't have so, she left a deposit and made subsequent payments when she could.

After her successful Texas tour Bessie returned briefly to Chicago. In January of 1926 she was on the road again for a lecture tour of Georgia and Florida. Bessie's travels finally took her to Orlando where she seemed destined to settle. Bessie lived with Reverend and Mrs. Viola Hill, who would treat her as a daughter. Knowing that Bessie was paying for her airplane in installments, Mrs. Hill suggested that Bessie open a beauty shop to supplement her income.

Edwin Beeman, a rich, white man, who was fascinated by aviation and whose family owned the Beeman Chewing Gum company, gave her money for her final airplane payment. Bessie arranged for the plane to be flown from Texas to Jacksonville, FL where an exhibition was scheduled for May 1, 1926. Finally, things were beginning to look up for Bessie.

The air exhibition was to be sponsored by the Negro Welfare League. They also arranged for a series of speaking engagements for Bessie at churches and theaters. Bessie also took it upon herself to visit the African American public schools so she could talk to the children about aviation as was her habit. The proceeds from this show plus money from the beauty shop would enable her finally to open her flight school.

In the meantime 24-year old white mechanic/pilot for Curtiss Southwestern Airplane and Motor Company, William D. Wills, had taken off from Love Field in Bessie's Jenny. It took Wills 21 hours to reach Jacksonville. Originally only three stops had been scheduled, but engine problems forced him to make two additional landings. Later local pilots were amazed that Wills had even made it to Jacksonville as the 90 horsepower engine was so worn and poorly maintained it could only develop about 60 horsepower at most.

On the morning of April 30, 1926, Wills and Bessie arrived at Paxon Field with John Betsch, the Welfare League's publicity chairman. As Bessie planned a parachute jump later in the day she wanted to check out the field for a good landing site, so she asked Wills to fly. Seated in the rear cockpit of the Jenny, Bessie left her seatbelt unfastened so she could peer over the edge of the cockpit and check the field. Wills climbed to 2,000 feet and circled for about five minutes. He then climbed to 3,500 feet and headed back to Paxon Field. Aviators who witnessed the flight said the airplane went into a tailspin at 1,000 feet. It then

flipped upside-down at 500 feet, tossing Bessie out of the cockpit. After somersaulting end over end she hit the ground crushing nearly every bone in her body and her dreams for a flight school for her people.

Wills in the meantime was struggling with the airplane's controls but failed. The plane crashed after shearing off the top of a pine tree near the edge of the field. Ironically, when police and Betsch arrived, Betsch was shaking so bad from shock that he decided to light a cigarette. The spark from the match ignited the gasoline fumes immediately engulfing the airplane and Wills' body in flames. The cause of the accident was discovered immediately in the charred remains. A wrench had slid into the control gears and jammed them.

Bessie's Federation Aeronautique Internationale pilot's certificate.

Bessie made one last journey to Chicago where she was met by a military escort from the African American Eighth Infantry Regiment of the Illinois National Guard and finally laid to rest at Lincoln Cemetery.

There will always be a question mark about what Bessie might have achieved as an aviator and an advocate for equal rights for African American women and men had she lived. But one thing we do know, Bessie Coleman was a woman ahead of her time. ✈

This article is based primarily upon the recently published, Queen Bess, Daredevil Aviator, *(Smithsonian Institution Press) by Doris L. Rich. Bessie is still an inspiration to many. She was honored in 1995 by the U.S. Postal Service with a Black Heritage commemorative stamp. Bessie may not have fulfilled her dream of a school for black aviators, but our minds finally opened enough that African Americans no long have to leave the country to learn to fly.*

For an example of a modern Bessie Coleman, read on.

Making History

The blue-white ice of Alaska's glaciers brought tears to her eyes as she made her first flight to Anchorage. Patrice Clarke Washington, born and raised in the Bahamas, recalled the pure enjoyment she had felt sitting in geography class in Nassau and learning about the glaciers and other fascinating things. "I wanted to see the world, its countries and people," she says. "For me this was exciting."

The flight to Alaska was one of many firsts for a young woman who set her sights not on making history but merely trying to carve out a satisfying career for herself—as a pilot, so she could se a little bit of this big world.

The 1982 aeronautical science graduate of Embry-Riddle Aeronautical University was promoted to captain on the DC-8 in November 1994. Both events remain uncommon achievements for a woman of African descent.

Captain Washington, 34, is one of only 2,000 women working as flying officers for major air carriers in the United States. Only 500 women are captains and only a dozen African American women are flight engineers or co-pilots for major carriers.

Patrice Clarke Washington acknowledges she has logged a number of "firsts" in her aviation career. "I am believed to be the first female of African descent to graduate the flight program at Embry-Riddle," she says. "I was the first female, African descent or other, to work for TIA (Trans Island Airways) and Bahamasair. The first Africa-American female to fly for UPS. The first African-American female to become captain for a major airline. My

husband and I are the first and only African-American pilot couple flying for the airlines." That last achievement was a result of her marriage to Ray Glenn Washington, an American Airlines pilot, in February 1994.

Captain Washington was hired in 1988 by UPS as a flight engineer aboard the DC-8 after flying four years as first officer aboard HS-748 and Boeing 737 aircraft for Bahamasair. She became first officer on the DC-8 in 1990.

Making History

Only four percent of all flight officers for major carriers are women, according to Lori Griffith, statistician for the International Society of Women Airline Pilots. Women are scarce in the flight cabin because of a history of discrimination in the profession, Griffith says.

After World War II, the U.S. Congress denied military status to the 1,800 women who had ferried planes across the Atlantic, flown cargo flights and done everything but combat duty during the war. Airlines initially only hired pilots with military backgrounds, Griffith says. It wasn't until 1973, Griffith says, that women broke the gender barrier with major airlines and catching up has been a slow process.

As an aviation student in the early 1980's, Captain Washington was almost always the only woman in class. Although it was lonely not having other women to share with, she says she ran into little harassment or discrimination. "I am quiet. I stay in the background, so I don't get noticed a lot. But when I need to assert myself, I can. Being quiet has nothing to do with assertiveness. I'm the kind of person who does what she has to do to get the job done." Lessons learned from her mother, perhaps.

Her mother, Peggy Lundy, "is my role model," Washington says. She watched her mother, a single parent, struggle to raise three daughters and make ends meet. There was no time or tolerance for "foolishness," and the household chores were shared by all.

The message at home was always that to get anything in life, you had to work hard, persevere, and trust...."

Her trust was tested one day in 1984, as a 23-year-old pilot of a 10-passenger twin-engine Trans Island Airways plane. She was 5,500 feet over the Caribbean—many miles from an airport—and one engine went dead. She had passengers on the plane, so she had to keep her cool. She kept the plane on course and made a smooth landing, on schedule, on the island of Eleuthera.

Her trust is tested from time to time in other ways, in the subtle—but sometimes overt—discrimination that women face from fellow crewmembers. "I feel it is necessary to point out that not all our male counterparts are sexist or discriminatory," Washington says, "but in every group there are a few rotten apples." Most of her co-workers, men and women, have been "very gracious and encouraging," she says.

That's good news for Lorraine Murrell, a 29-year-old student pilot who once saw Patrice Clarke Washington step out of a UPS DC-8 cockpit and decided she too could pursue such a dream.

"I was in shock," says Murrell adding that she had never seen a black woman pilot. She was working for UPS in Anchorage in 1992 to pay her tuition at the University of Alaska. Two days later, with a bachelor's degree in language and literature in hand, she abandoned plans to attend law school and pursued an aviation career. "That's when I found how difficult it would be," Murrell says.

She investigated the Air Force, Navy, and Marines but found she was too old for the military. She tried the civilian route, calling commercial flight schools. When she learned it would cost $30,000 to $35,000 to go from "ground zero" to certified flight instructor, she kept looking. In August 1994 she discovered the Organization of Black Airline Pilots (OBP). She attended the group's conference in Washington, DC, where she had the thrill of finally meeting Patrice Clarke Washington.

After the conference, Murrell checked out the university flight programs in Virginia, Arizona, Florida, and Minnesota and then got a scholarship from the OBP to enroll in a flight program. She still says she is determined to become an airline transport pilot.

Lorraine Murrell and Patrice Clarke Washington follow in the path of Bessie Coleman, who in 1921 had to go to France to learn to fly and became the first black woman aviator.

But they are all paving the way for many more who will follow them. ✈

This article is reprinted with permission from The Leader, Embry Riddle Aeronautical University's semi-annual magazine.

OUR NEW LOOK

You may have noticed the new masthead on the November/ December 1995 issue. What you may not have been able to notice is that the front and back covers of that issue were entirely computer-generated. The new masthead, the November/December covers, and the new look for FAA Aviation News are the propriety of our newest staff member, A. Mario Toscano. Rest assured, the changes are cosmetic only; we believe the "facelift" will bring us to an eye-appeal level with any commercial publication. Yet, we will always strive to keep FAA Aviation News as the most informative of them all. Let us know what you think or give us your suggestions via letter or e-mail.

THE PAPER AND INK USED IN THE ORIGINAL PUBLICATION MAY AFFECT THE QUALITY OF THE MICROFORM EDITION.

PLAN TO FAIL?

By Capt. Scott McCartt

This article refers mainly to multi-engine helicopters, but it also offers some valuable lessons for single-engine pilots.—Editor

How many takeoffs have you made in your career? How many of those have been interrupted by an engine or driveshaft failure? If there isn't a big difference in those two numbers, you may wish to reconsider your choice of employment!

Fortunately, the reliability of modern equipment is so good that such problems are very rare. Combine reliability with the relatively small percentage of flight time spent in the takeoff regime, and it's very easy to be lulled into a false sense of security. A recent trip to [a] Bell 212 simulator refreshed my memory on just how quickly a helicopter can shatter that illusion if you aren't prepared.

The early stages of a takeoff are some of the most crucial moments of flight. Drivetrain stress and power requirements are high, and low airspeed/altitude combinations all conspire to provide few options. Terrain and obstacles often present additional hazards. The result is an environment where knowledge and training are key elements in dealing with mechanical failure. While your choices and decision making will be based largely upon the type of equipment you are operating, you will undoubtedly be looking for a place to land if the main driveshaft should depart the fix. Regardless of the equipment, procedural knowledge, good planning, and good crew coordination will still be required.

It should go without saying that at least in part the ability to keep the aircraft flying after a mechanical failure means knowing the operating manual. However, knowing that the aircraft will fly out of or can be safely landed after a 30 knot engine failure doesn't help you clear that 60 foot obstacle during the recovery. The information obtained from study must be applied to each departure problem before it is useful.

So, how do you plan a departure? While there are as many planning methods and acronyms as there are pilots, most address common elements in the normal departure equation (pilot, aircraft, terrain, obstacles, load, weather, etc.). But what happens when the "normal" takeoff suddenly becomes abnormal? For example, the first maximum performance takeoff method many of us were taught involved a slight acceleration toward the obstacle followed by a normal acceleration immediately upon clearing it vertically. This was the "school solution," and it made for a great view through the chin bubble when clearing the pine trees. Would I use it now? Probably not, because it didn't allow for the unexpected. Any kind of drivetrain problem would have transformed our wonderful flying machine into a very expensive wood chipper.

The "school solution" now in use involves a vertical ascent until well clear of the obstacle, followed by a quick acceleration allowing a return to the takeoff area or trade of altitude for airspeed should one of the [engines] decide to take a lunch break. The bottom line is this: ALWAYS leave yourself an "out" in the takeoff planning process. If you don't have an escape or abort plan, carefully consider whether or not continuing is worth the aircraft or your life—you won't have time to

plan after the engines or drive shaft takes a vacation.

Okay, so we know the capabilities of the aircraft, can execute the emergency procedures with efficiency, and we've got an emergency plan in the back pocket. We're good to go, right? Well, maybe.

Do the people you're working with know what you're going to do? Having spent much of the last five years flying single pilot in the Huey caused me some initial grief in [the] simulator because I wasn't used to working with a flight engineer. On my initial maximum performance takeoff, we had a single engine failure at about 30 feet. Following my plan, I lowered the collective, regained RPM, and cushioned the landing using the remaining engine. At that point, the instructor stopped the sim and asked the engineer if he knew what I had planned to do. The before takeoff checklist included a crew brief, but I had failed to verbalize my abort plan. Harry did his best to cover my omission with something about having a pretty good idea, but he wasn't absolutely sure what I was going to do. Of greater importance was the fact that I hadn't told him how he could help me during the recovery. Thus, the fact that we didn't bend the aircraft was more a function of luck than planning. I was trying to watch rotor RPM, torque readings, rate of descent, and drift simultaneously, while Harry tried to figure out how to help. Don't try this at home; it doesn't work very well. There is a better way.

While allowing my ego time to recover from that bashing, we analyzed the events and determined a better way to deal with them. In this scenario there are two immediate concerns: keeping the rotor RPM in the green arc and effecting a level landing with minimum rate of descent and drift. One requires concentration inside the aircraft and the other requires concentration outside. The first attempt illustrated the difficulty in doing both, so the solution was to split the jobs between the two of us. Harry called out rotor RPM and watched the engine limits while I kept my attention outside and used visual cues for attitude, drift, and rate of descent. The second failure, at 50 feet, resulted in a smooth touchdown, no drift, and no damage to the good engine. With both of us working together, the emergency recovery was much smoother, positive, and controlled. Chalk another one up for the Crew Resource Management advocates.

Okay, so you fly single pilot with no one to help you. Does letting people know your intentions still apply? Unless you're solo, in the middle of the wilderness, then probably. Do your passengers know what to do in the event of problem? Does the ground handling team know where not to be when you depart? What if the construction crew drives a truck through the middle of your emergency abort path? If your departure involves contact with people in almost any capacity, then they need to know your plans in the event of an emergency return. The last thing we want to have is someone standing right in the abort area when the bird quits.

Fortunately, statistics show that perfectly normal departures are the norm rather than the exception. This fact, in itself, is truly a tribute to the engineers, manufacturers, and maintainers who make it possible for the air crews to do their thing. Unfortunately, this reliability makes it difficult to maintain a mindset that expects the unexpected and plans for failure. Combating this mental trap requires a thorough working knowledge of the aircraft, good planning, and good crew coordination. Hopefully, your next encounter with the unexpected will only be in a simulator!

Fly safely!

Capt. McCartt is the military liaison for the Mid-Atlantic Helicopter Association (MAHA), and this article first appeared in the October 1995 issue of the MAHA Newsletter.

HUMAN (MAINTENANCE) FACTORS

by Alan Hobbs

This article, written by an Air Safety Investigator (Human Performance) for the Australian Bureau of Air Safety Investigation, comes to us by way of our aviation friends "down under"—the Asia Pacific Air Safety magazine and New Zealand's Civil Aviation Safety Supplement, Flight Safety. The spelling and some of the terminology reflects the country of origin.—Editor

On 11 September 1991, Continental Express flight 2574 was on descent into Houston, Texas on the return leg of a Houston-Laredo service. On board the Embraer *Brasilia* were 11 passengers, the two flight crew, and a flight attendant. As the aircraft descended through 11,800 feet, the leading edge of the left horizontal stabiliser separated from the aircraft. As a result of the aerodynamic disruption, the aircraft pitched down and broke up in flight. All 14 persons aboard were fatally injured.

As the investigation progressed, attention focused on the maintenance of the aircraft. The night before the accident, work had been carried out on the Brasilia's "T-tail," involving the replacement of de-ice boots on the leading edge of the horizontal stabiliser. The work was only partially completed when a shift change occurred. The screws holding the de-ice boot to the upper surface of the left horizontal stabiliser had been removed in anticipation that the de-ice boot would be changed. However, the screws on the lower surface had been left in place. Workers on the incoming shift were not aware that any screws had been removed from the left side of the tail and apparently did not see the bag of removed screws which had been left near the aircraft. Due to time constraints, it was decided to replace the left de-ice boot at a later date, and the aircraft was signed back into service with the upper screws missing. The flight crew would not have been able to see the upper surface of the horizontal stabiliser during the morning pre-flight check.

The National Transportation Safety Board investigation identified deficient maintenance practices within the airline and raised concerned about the adequacy of FAA surveillance of airline maintenance.

The Number-Two Safety Issue

Human error in maintenance is only just beginning to receive the attention it deserves. Air safety statistics frequently list maintenance as a minor causal factor in airline accidents. Yet, when safety issues are presented alongside the fatalities which have resulted form them on worldwide airline operations, maintenance and inspection emerges as the number-two safety issue after controlled flight into terrain. Maintenance lapses are not just costly in terms of life and property but can also cost an airline dearly, as aircraft are delayed, diverted, and turned back.

In one of the few attempts to analyse the types of errors which occur in maintenance, the UK CAA has reported that in a three-year period, the top eight maintenance problems affected aircraft over 5,700 kg (12,540 lbs.) were:

- Incorrect instaliation of components
- The fitting of wrong parts
- Electrical wiring discrepancies (in cluding cross-connections)
- Loose objects (tools, etc.) left in the aircraft
- Inadequate lubrication
- Cowlings, access panels, and fairings not secured
- Fuel and oil caps and refuel panels not secured
- Landing gear ground-lock pins not removed before departure

The following examples illustrate how apparently simple maintenance oversights can contribute to major disasters.

In 1991 a Canadian-registered DC-8 departed Jeddah, Saudi Arabia, with two under-inflated tires. Although several maintenance personnel knew of the low tire pressures, they were not aware of the hazards of operating at low tire pressures. During the takeoff run, two tires failed, igniting rubber fragments still attached to the wheel. When the landing gear was retracted the fire spread to the wheel well and eventually burnt through control systems. The crew lost control of the aircraft as they attempted to return to the airport for an emergency landing. All 261 aboard were killed.

In June 1990, the windscreen of a British Airways BAC.1-11 blew out as the aircraft climbed through 17,300 feet. The accident was traced to the incorrect installation of a new windscreen during the night shift before the flight. The windscreen had been installed by a shift maintenance manager using incorrect bolts.

Yet, listing the physical descriptions of what happened does not assist in understanding why these events occurred.

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Maintenance—the Challenge

As the aviation industry begins to look at the human factors which affect the quality of airline maintenance, it is becoming apparent that maintenance faces some special challenges.

In the early days of flight, pilots endured noise, wind, and extreme temperatures as an accepted part of aviation. Maintenance technicians must still contend with the elements in ways that few airline pilots are required to do. A maintenance worker may be required to perch high above the ground, perhaps in rain and darkness, communicating by hand signals through deafening noise.

Maintenance is different in other ways as well. An air traffic controller can unplug from the console at the end of the day, knowing that the day's work is finished. When the flight crew leave the aircraft at the end of a flight, the chances are that any mistakes they made affected that flight only (unless they damaged the aircraft). But when maintenance personnel head home at the end of their shift, they know that the work they performed will be relied on by crew and passengers for days, weeks, or even years into the future.

Maintenance personnel are called upon to solve a diverse range of problems. Diagnosing a problem on the basis of a sketchy report by a pilot can call for creative thinking and experience. But creative thinking can sometimes create new, unexpected problems.

To illustrate—in May 1979 an American Airlines DC-10 crashed shortly after taking off from Chicago. At rotation, the number-one engine and pylon broke away from the wing, severing hydraulic lines. As the aircraft climbed away, hydraulic fluid was lost, and the outboard slats on the left wing retracted, while the slats on the right wing remained extended. The aircraft rolled to the left and descended into the ground. All 271 people on board and two people on the ground were killed.

The engine pylon had failed as a result of a fracture that was attributed to maintenance practices at the airline. Although the manufacturer specified that the engine and pylon should be removed separately, the airline had developed a one-step maintenance procedure in which the engine and pylon were removed as one unit. This not only saved about 200 person-hours of labour but also was considered safer, as it reduced the number of fuel lines, hydraulic lines, and wires which needed to be disconnected.

The procedure adopted by the airline involved supporting the engine with the use of a forklift. The safe completion of the procedure relied upon accurate movement of the forklift to avoid damaging the pylon and its attachment points. Unfortunately the engineers who wrote the procedure were not aware that the forklift could not be controlled with sufficient accuracy. The engineers never observed the entire procedure being performed by maintenance personnel, and they were not aware that the procedure was more difficult than planned.

In the year before the accident, another airline using the same procedure had damaged engine pylons, yet the damage had been blamed on "maintenance error." The cause of the problem was not fully investigated, and the damage was not reported to the FAA.

Many maintenance tasks are too large to be completed in a single shift, and the resulting handover is a significant challenge to job quality. Paperwork generally ensures a seamless continuity of work tasks; however, cross-shift misunderstandings can still occur. The Brasilia accident described at the beginning of this article illustrates the dangers inherent in shift handovers.

Maintenance is driven by paperwork. Although the maintenance manual and task cards specify the procedures to be followed, there is the potential for a divergence between the procedures on paper and the way the job is actually performed. Reducing the gap between procedures and practice is not just a matter of making workers do the work "by the book;" it is also necessary to ensure that the procedures are realistic and as convenient as possible. Informal work practices or "norms" often replace cumbersome or unworkable standard procedures. Because norms are not documented and rely on assumptions about "the way we do things around here," deviation from an expected norm can be as dangerous as deviation from a formal procedure.

While checklists have become essential aids to flight crew, maintenance has come to rely on the sign-off of task cards and other documentation as an assurance that work has been satisfactorily completed. While there are benefits in this system, there are a number of potential problems, including the risk of "serial sign-off," where a large number of tasks, some possibly incomplete, are signed off at once.

At most airlines, maintenance managers are faced with the challenge of coordinating the work of diverse work teams. Crew resource management (CRM) is an essential element of flight crew performance. Yet, flight crew do not in general have to coordinate with other crews in the course of a flight. But an aircraft on the ground may be worked on by several maintenance crews simultaneously. Maintenance faces all the problems of coordination of work within crews but also faces the potential greater challenge of coordinating work between crews.

Finally, maintenance workers must contend with shiftwork and fatigue

without the benefit of duty-time limitations.

Organisational Problems

There is no simple way of ensuring that maintenance errors will not occur. However, an important step toward maintenance safety is the recognition that maintenance quality lapses may be indicators of wider organisational problems.

Organisational factors were exposed in 1983 when a U.S.-operated L-1011 experienced a triple engine failure. The aircraft was en route from Florida to the Bahamas. On descent to the destination, the low oil-pressure warning light on the number two engine illuminated, and after shutting down that engine the captain decided to return to Miami on two engines. While returning to Miami, the oil warning lights on the remaining two engines illuminated, and at 16,000 feet the number three engine flamed out, followed five minutes later by the number one engine. The aircraft descended without power to 4,000 feet, at which point the number two engine was restarted. A successful one-engine landing was then made at Miami.

The investigation revealed that, on all three engines, master chip detectors had been installed without O-rings, allowing oil to leak from the engines in flight. Over a period of 20 months, the airline had experienced 12 separate incidents involving in-flight engine shutdowns and unscheduled landings due to problems with O-ring seals and master chip detector installation problems. As the NTSB reported, "In every incident...management investigated the circumstances and concluded that the problem was with the mechanics and not with the maintenance procedure." Rather than addressing the wider system problems, the incidents resulted in individual disciplinary action and additional training.

A deeper investigation by management may have revealed that an informal work practice (or norm) had developed at the airline, whereby mechanics were routinely issued with chip detectors with the O-rings already installed. When an exception to this established norm occurred and chip detectors were issued without O-rings, the mechanics did not notice that the O-rings were missing.

Of course, maintenance engineers must take responsibility for the quality of their work. But blaming workers for complex quality lapses sometimes diverts attention from long-standing organisational problems. In the case of the BAC.1-11 accident referred to earlier, there was evidence that the error of the shift maintenance manager was partly a reflection of failures of management, procedures, and the regulatory authority. For example, the procedures for changing a windscreen at the particular airline had few system defences or backstops. No one checked the work of the shift maintenance manager, and there was no requirement to pressurise the aircraft on the ground after a windscreen change.

A second organisational flaw which can afflict maintenance organisations is a reluctance to report difficulties or errors, sometimes because errors are seen as insignificant. Yet, as has been illustrated earlier, seemingly insignificant problems can have very serious consequences.

What Can Be Done?

Having demonstrated that human factors and human error are real threats to the quality of maintenance, it is time to consider what can be done about the problem.

As a first step, it is important to acknowledge that human error is an unavoidable reality. Systems and procedures must be designed to anticipate minor error and to prevent them form contributing to major problems. For example, designers have a responsibility to produce systems and components which cannot be installed wrongly. Management should also recognise that shift changes, night work, and other conditions can increase the chance of errors.

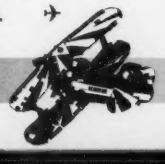
Before things go wrong, maintenance organisations should recognise that the origins of problems may lie as much with the organisation as with individual workers. From time to time, it helps to ask questions such as the following.

- Would work grind to a halt if things were done by the book?
- Does maintenance quality ever take second place to commercial pressures?
- Are incidents investigated and publicised within the company?
- Is there a system in place to allow maintenance personnel to express their concerns?
- Are workers afraid to admit their mistakes because of a fear of punishment?

After an incident has occurred, it is important for the organisation to assess why it happened without merely looking for people to blame. Incident investigations are an excellent opportunity to discover weaknesses.

Training of maintenance personnel in human factors and crew resource management can also help to avoid human-related problems. Crew resource management for maintenance has already been successfully introduced by some North American carriers. Participants learn about issues such as stress and work pressures, and they are taught to communicate clearly and assertively.

Sadly, it sometimes takes an accident or serious incident before there is agreement on what needs to be changed within the organisation. It is far better to identify the human factors and organisational failings before they have an opportunity to cause trouble, because reacting to disasters after the event is a costly and inefficient way of improving safety. ✈



How Long Can You Tread Water?

by Donald E. Hall

Once Upon a Time—

My wife and I had just departed Hyannis Barnstable Municipal Airport for Nantucket Island for a much needed get-away weekend. The day was slowly ending with an absolutely breath-taking sunset, and our flight time would only be about 20 minutes at an altitude of 3,500 feet. My wife and I had made this trip many times in all kinds of weather, but this evening was special because of the gorgeous sunset before us.

We were 10 minutes out of Hyannis when the dreaded sound of silence filled the cockpit. We heard a loud bang followed immediately by the engine going to idle. I began to do my emergency procedures while trying to glide to the distant shoreline of Nantucket Island. I tuned 7700 in the transponder and began to call mayday on 121.5. Both Hyannis tower and Cape approach answered me. I went on to explain what had happened and gave our approximate position.

The engine had quit without any warning! I immediately switched fuel tanks, selected mixture to full rich, turned on the boost pump to high, mags on both, and tried to check anything else that might help our situation. Nothing I tried could get the engine restarted. When I realized we could not reach the airport or stretch our glide to any land, I elected to ditch the aircraft.

Our aircraft was a low wing aircraft with retractable landing gear. Our altitude was now 500 feet, and the water was not as smooth as it appeared at 3,500 feet. The waves were two to three feet high with small white caps.

I made the best gear-up landing of my life in the cold, winter waters of the Atlantic.

The aircraft came to rest right side up, intact, and floating. I hoped that my mayday transmission rescue would soon be on its way. The U.S. Coast Guard had launched a Falcon jet to locate us.

I had located our life vests and the flare gun before the ditching, and we had donned the life vests. I had done everything correct up to this point, and we were sitting on the wing when the aircraft began to sink. It had been five minutes since we ditched, and the aircraft was now awash and sinking fast. As the aircraft sank, so did the setting sun and our hopes of rescue.

After just a few minutes in the cold water, our legs and arms were numb. The numbing cold prevented my fingers from firing the flare gun as the Falcon flew above us in the darkness. The U.S. Coast Guard jet was on scene in about 10 minutes but could not locate any wreckage or people because of the impending darkness and the rough seas.

Preventing an Unhappy Ending

This fictitious story should not have ended. There was one more thing the pilot could have done to prevent this tragedy. He could have purchased a hand-held, waterproof ELT for his flight bag.

These units are more commonly referred to as an "EPIRB" or Emergency Position Indicating Radio Beacon in the marine environment.

Now, don't confuse a hand-held ELT with the ELT mounted in the tail of the aircraft. ELT's mounted in the tail are not waterproof, they don't transmit under water, and most installations do not have a remote activation switch in the cockpit. But, as we said, even if you could activate the ELT from the cockpit, it would not transmit a readable signal under the water. Both the ELT and the EPIRB operate on 121.5 and 243.0 (military), which can be received by over-flying aircraft and SARSAT satellites.

The hand-held EPIRB has been used extensively by most mariners for marine distress situations. The hand-held, waterproof EPIRD is not new to the market. They have been around for years, but most people don't consider them a necessary piece of lifesaving equipment, or maybe they think they're too expensive. How does under $250 sound for the price of your life?

Some survival ELT's or EPIRB's can be manually operated or automatically actuated upon contact with the water, and they even float! Survival ELT's or EPIRB's are required ditching equipment for transport category airplanes and rotorcraft, as provided by the operating rules. They are also required emergency equipment for extended overwater operations on aircraft used in air carrier, air taxi, and commercial operations. Flying over water without one of these is like watching your house burn because you don't own a fire extinguisher.

So, what is your excuse?

Want to go a Step Further?

Take a look at the new 406MHz ELT. Although a little more expensive, these units are manually or water-activated and will immediately pinpoint your location for Search and Rescue (SAR) authorities with precision. These units can be installed in your aircraft, or hand-held units can be carried in your flight bag.

The 406 ELT offers significant safety benefits not found in ELT's based on older technology, which broadcast only on 121.5 and 243.0.

Why is the 406MHz ELT Better?

One reason is the 406 transmits a coded digital data signal which, if properly registered, provides the owner's personal identification, including name, address, telephone number, country code, aircraft identification number, type, color of aircraft, or any other data you want included. This data allows

Readback/Hearback

by Bill Monan

Problems

What's going on up there? puzzle ATC controllers in their reports to NASA's Aviation Safety Reporting System (ASRS) involving numerous pilot errors in clearance readbacks.

What's going on down there? query airmen reporters who dutifully read back ATC instructions only to be subsequently informed that they have "busted" their altitudes, turned to wrong headings, lined up with wrong parallel runways, or have descended below minimum safe altitudes.

"What's going on"—as indicated in ASRS data—is that all too frequently airmen are reading back wrong numbers and the ATC controllers are failing to catch the pilots' errors in the readbacks. We call this the *hearback problem.*

The ASRS has published several studies on pilot/controller communications breakdowns. The FAA and the industry have actively campaigned for improvement in these areas. Yet, ASRS submissions confirm the hearback problems in pilot/controller communications continue to be acute.

Causes of Communications Breakdown

Why aren't pilots "getting it straight?" We examined a sample set of ASRS reports from airmen and controllers, and identified four major patterns of causal sources for pilot errors in their readbacks.

Readback Problems

Similar aircraft call signs.

Airlines with their hub operations, have set a major trap for their airmen. Trips 401, 402, 403...Flight ABC1 and XYZ1, GYC and GYE—all operating on the same frequency, at the same time and in the same airspace. "Good for marketing," protested a reporter, "no good for us."

Only one pilot listening on ATC frequency.

"Picking up the ATIS" and "talking to the company" represented a time-critical gap in backup monitoring during two-pilot operations.

Slips of mind and tongue.

The typical human errors in this category included: Being advised of traffic at another flight level and accepting the information as clearance to that flight level; the classic "one zero" and "one one thousand" mix-up; the L/R confusion in parallel runways; the interpretation of "maintain two five zero" as an altitude rather than an airspeed limitation.

Mind-set, pre-programmed for..., and expectancy factors.

The airmen who request "higher" or "lower" tend to be spring-loaded to "hear what we wanted to hear" upon receipt of a blurred call sign transmission.

The incident set included traffic conflicts, altitude busts, crossing restrictions not made, heading/track deviations, active runway transgressions, and mix-ups of takeoff clearances and parallel runways.

How Long Can You Tread Water?

the National Oceanic and Atmospheric Administration's (NOAA) U.S. Mission Control Center (USMCC), located in Suitland, MD, to not only quickly locate a 406MHz signal to within one to three miles but also to tell the USMCC whose signal it is. This identification information makes it easier for the authorities to find and deactivate inadvertent activations as well as check on real alert signals **QUICKLY!**

Mounted on top of the 406MHz is a powerful xenon strobe that flashes brilliantly to aid in nighttime and low visibility searches.

What are the Benefits?

The benefit of the 406MHz system is in how the satellites receive and relay the two types of distress signals. The 121.5 MHz-based system requires that both the ELT signal source and a ground receiving station be within satellite view of the receiving satellite at the same time. If a ground receiver station is not in view when a satellite receives a 121.5MHz distress signal, the signal goes unreported until both the ELT site and a ground receiver site are in view of the satellite. This can result in significant delays in initiating search and rescue efforts; i.e., this process may take more than one satellite pass of the crash site before authorities are notified.

In the 406MHz system, the receiving satellite does not have to be in view of both the ELT site and ground receiver station. The satellite can store the 406MHz signal until it passes over the first available ground station, and then the satellite can download the signal data to the ground receiver station. This ability to store and then alert can reduce SAR alert times to within minutes of the emergency signal's activation. This often means the difference between life or death for accident survivors.

All of these units come with an extra longlife lithium battery, a six-year replacement life (12-year shelf life), and an operating life of 48 HOURS!

What's your operating life in "cold, November waters?" ✈

Mr. Small is an aviation safety inspector at the Boston, MA Flight Standards District Office.

Two reports of controlled flight toward terrain were reported.

Hearback Problems

"Why didn't the controller catch the pilot error?" was the questioning theme in the data set. While the sources for pilot readback failures were clearly delineated in the narratives, hearback deficiencies diffused into a tangle of erratic, randomly overlapping causal circumstances. But the underlying problem seems to be the sheer volume of traffic: the "9 a.m. - 5 p.m." rush of departures/arrivals; the behind-the-scenes tasks of land-lines, phones, and handoffs; the congested frequencies with "stepped on" transmissions; the working of several discrete frequencies; and, at times, the time and attention-consuming repeats of call-ups or clearances to individual aircraft. These activities, together with human fallibilities of inexperience, distractions, and fatigue set the stage for hearback failures. Indeed, a series of pilot narratives recognized controller "overload," "working too many aircraft," "overwork," and frequency saturation.

Digging Deeper

The report set included a number of aggressively optimistic assumptions on the part of pilots regarding ATC performance. Reluctantly, but more and more frequently, airmen are accepting silence as a confirmation that readbacks are correct. Pilots respond to doubtful or partially heard clearances with perfunctory readbacks expecting controllers to catch any and all errors.

Airmen hold to the illusion that ATC radar controllers are continuously observing their aircraft as they progress through the airway structure. The reality is that controllers continually scan the entire scope; they generally do not focus on individual targets. Descent clearances that "seem a little early" or altitudes that "seem too low" or turns in the wrong direction may well be intended for another aircraft.

Finally, airmen who fail to brief upon minimum safe altitudes within or near a terminal area or during the approach phase are vulnerable to readback/hearback errors leading to "controlled flight into terrain." Such an event is described in an ASRS report from a shaken pilot who admitted to not checking the charts prior to a night time descent:

"The dim shape of the mountain came into view...seconds before the 'WHOOP...WHOOP...PULL UP' sounded. We both pulled abruptly on the controls and climbed..."

The ATC controller's report added further details:

"The tapes revealed that I had told the pilot to descend to 7,000 feet (6,500 is the MEA) but he had read back 5,000. He got down to 5,700 feet, about 2 miles from a 5,687 foot mountain before I saw him."

Summarized the airman, "I don't know how much we missed by, but it certainly emphasizes the importance of good communications between controller and the pilots."

"Reading the tape" was the final administrative step that identified the readback/hearback sequence in a recent NTSB assisted international accident investigation:

Time - 0632
CONTROLLER:
"Air carrier ABC, descend [to/two] four zero zero. Cleared for the NDB approach..."
PILOT:
"Okay, four zero zero."
TAPE READOUT:
"WHOOP WHOOP PULL UP"
"WHOOP WHOOP PULL UP"
Time - 0634
SOUND OF IMPACT

Summary and Recommendations

When pilots read back ATC clearances, they are asking a question: "Did we get it right?" Unfortunately, ASRS reports reveal that ATC is not always listening. Contrary to many pilots' assumptions, controller silence is not confirmation of a readback's correctness, especially during peak traffic periods.

Pilots can take several precautions to reduce the likelihood of readback/hearback failures:

- Ask for verification of any ATC instruction about which there is doubt. Don't read back a "best guess" at a clearance, expecting ATC to catch any mistakes.
- Be aware that being off ATC frequency while picking up the ATIS or while talking to the company is a potential communications trap for a two man crew.
- Use standard communications procedures in reading back clearances. "Okay's," "roger's," and mike clicks are poor substitutes for readbacks.

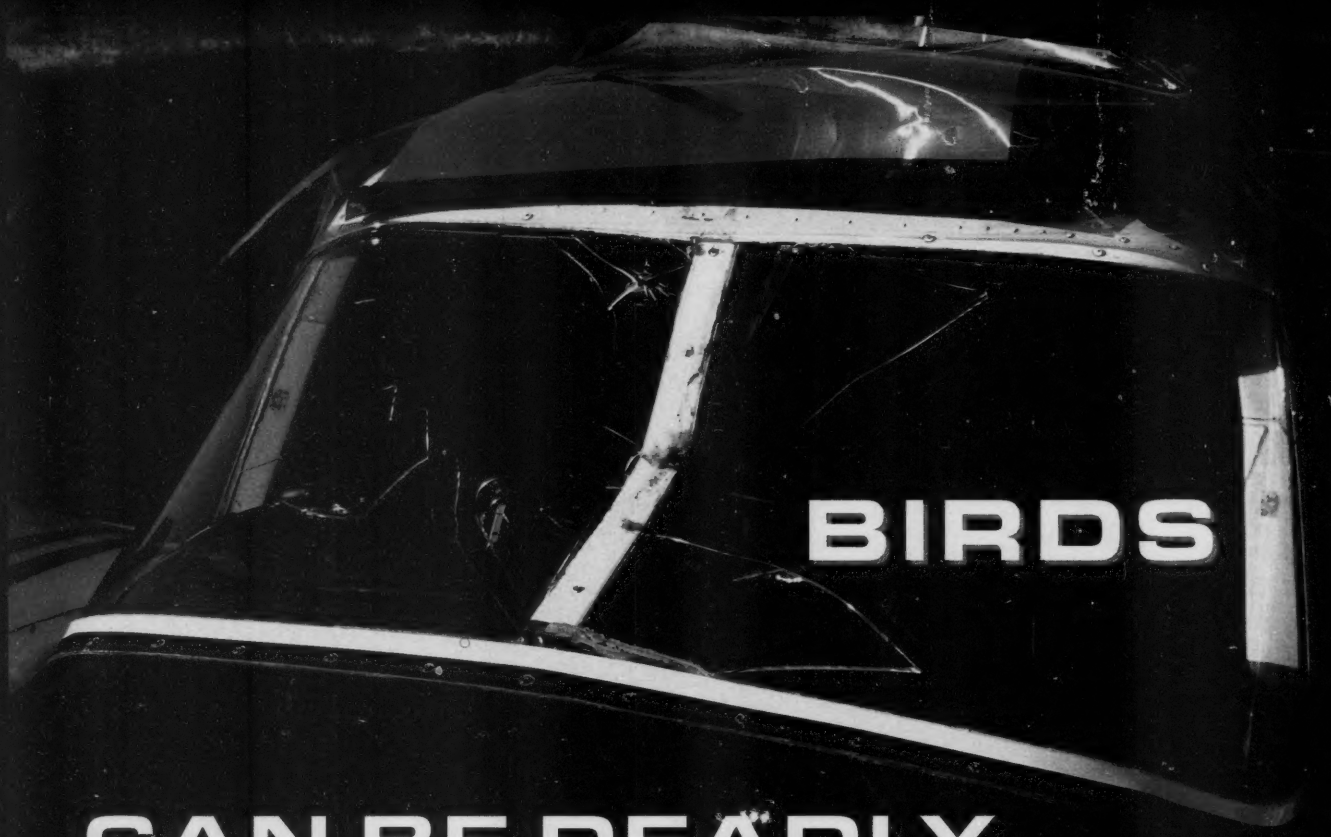
Controllers can also take steps to safeguard against readback/hearback failures:

- Be aware that an altitude mentioned for purposes other than a clearance, such as a traffic pointout, may occasionally be interpreted by pilots as an instruction to go to that altitude.
- Deliver cautionary messages such as "similar call signs on frequency" to help reduce call sign confusion. [already a requirement for controllers—Editor]

The Future

Reflecting a major trend in ASRS data, the report poses troublesome questions concerning the ATC/pilot communications procedures. Are traffic growth and congested frequencies compressing the traditional to-from-to exchanges into a one-way transmission? Are airline managements aware of the similar call sign problem? Are airmen placing full-time confidence upon a confirmation procedure that works only part of the time? Can Data link help solve some of these problems? ✈

Bill Monan was on the ASRS Technical Staff and an air carrier captain when this report was published in the Winter 1990 ASRS Directline.



BIRDS CAN BE DEADLY

Story and Photos by H. Dean Chamberlain

Some might say flying is for the birds. Others might even say that birds invented flying. But regardless of what you think about birds and flying, we think birds have been flying relatively safely for millions of years. We don't know for sure, since the FAA has no Neolithic bird accident statistics on file. Apparently, the government's data systems weren't on-line then.

A quick review of history lists only one reported flight accident involving some type of bird-like experimental aircraft made of feathers and wax. Apparently the reported midair breakup was caused by the sun's heat. According to early, unconfirmed reports, important flight feathers fell off the pilot because the heat melted the wax attaching the feathers to the man when he busted his assigned altitude and flew too close to the sun. But it must have been a myth because we all know a little bit of sun could never melt FAA-approved, TSO'd, human-feather-attachment wax. Plus, we all know that no FAA inspector would ever sign off on an experimental "aircraft" made of wax and feathers. Mylar maybe, but not feathers.

Today, we have a different problem involving feathers and birds. Humans have mostly gone beyond trying to imitate birds flying, but we still have a problem with our fine feathered friends. Ever since humans started to fly, birds and bird(persons/men/women, your choice) have managed to collide with each other with increasing frequency and with increasing damage. It seems that birds and flying humans just can't stay out of each other's way.

Although birds and some pilots (such as glider pilots who often share the same thermal with soaring birds) can operate near each other with relative safety, birds can and do occasionally strike great fear in the hearts of the most intrepid aviators because a bird strike through the cockpit can ruin any pilot's day, especially if the bird is a big, fat goose.

The problem is easy to understand. It is harder to fix. In today's world of ever expanding urban areas, increased air operations, and decreasing amounts of unused airspace, it is inevitable that birds and aircraft are going to conflict with each other both in the air and on the ground. Bird strikes and jet engine bird ingestion have caused aircraft to crash. Birds have also caused millions of dollars of aircraft damage. The birds lose too; few birds escape a midair collision or engine ingestion unharmed.

Jet aircraft are even more vulnerable to birds than prop aircraft. Although the larger jet engines are designed to be able to ingest an occasional small bird with minor damage to the engine, a large bird or large numbers of smaller birds sucked into a jet aircraft's engines have caused more than one aircraft to crash. In other

cases, cockpit strikes have disabled pilots. In some of those strikes, the pilot or a copilot was able to safely land the aircraft. In a few cases, the aircraft crashed.

Military aircraft are especially vulnerable to cockpit bird strikes when the aircraft is flying low and fast on nap of the earth training missions at 500 feet and 500 knots. The U.S. Air Force has spent considerable money and effort to develop safer canopies for its low flying aircraft. One large bomber reportedly crashed because of birds. According to a 1993 Air Force study titled "Determination of Body Density For Twelve Bird Species,"—a project designed to develop test data for bird strike research—Air Force aircraft average 3,000 to 3,500 bird collisions each year at an annual cost of more than $65 million. The report also noted a 1992 report which said seven Air Force personnel had died from bird strikes between 1987 and 1992.

Regardless of the type of aircraft involved, military or civilian, bird strikes are a classic case of "lose/lose" for both the bird and the aircraft.

We printed a tongue in cheek article called "The Kamikaze Kanaries of Operation Revenge" in our March-April 1992 issue. The article discussed the dangers of bird strikes from the bird's perspective and told of actions birds can take to eliminate the metal pollution of aircraft from the bird's natural flight environment. It was a humorous way to point out some important flight safety issues for pilots when dealing with birds. In this article, we want to discuss the issue seriously from a pilot's perspective.

Two items brought the importance of bird strikes to mind. One was seeing a flock of about 50 large Canada geese flying in their classic "V" formation about two miles south of Washington National Airport. Fortunately, the geese where flying relatively low, and they were westbound on the west side of Alexandria, VA. They were not on the east side of the town which is along the Potomac River just south of the airport and down river from Washington, DC. The scary thought is they could have already flown low across the river.

Birds flying over or across the Potomac River near National Airport are always a threat because jet aircraft arriving and departing the airport have to fly over the river both inbound and outbound to avoid the prohibited airspace over Washington and for noise abatement. In addition to migratory birds such as the geese (which today seem to migrate less and less in the Washington area), National Airport has a year-round problem with gulls on and near the airport. Other airports have similar problems with local bird populations such as JFK International Airport in New York which is located near a protected bird breeding area. In other cases, landfills or dumps near airports attract large numbers of birds which then threaten the safety of flight operations.

BIRD STRIKE PREVENTION TECHNIQUES

The other important item which resulted in this story was seeing an article in the Orlando, FL, FSDO-15 Aviation Safety Program Newsletter on how to avoid bird strikes. Written by the Florida Association of Flight Instructors, the article said about eight aircraft are lost each year because of bird strikes. In paraphrasing the article, it said if you hit a two-pound seagull while you are flying at 120 mph, the resulting impact would have a force equal to 4,800 pounds. If you are flying in a jet at 600 mph the same impact would have a force of 72,000 pounds. The newsletter noted, "Some anti-aircraft rounds exert less force than that."

The article listed several suggestions to help pilots avoid bird strikes:

- Don't fly beneath a flock of birds because birds tend to dive to avoid danger. Pilots should pitch up to try to avoid a bird collision because the bird will probably dive.
- Turn on your landing lights when flying near areas with birds. The lights might help the birds see you in time to get out of your way. [Editor's Note: Don't expect the birds to turn on their landing lights for you. They were not type certificated with electrical systems or landing lights. They also don't have transponders for the same reason.]
- The final suggestion is to avoid flying near areas where birds concentrate such as marshlands, dumps, and landfills.

PRIME MIGRATION PERIODS

The FAA *Aeronautical Information Manual* (AIM) has a complete section on bird hazards—Section 4, Chapter 7, on page 7-4-1. According to the AIM, 90 percent of the reported bird strikes occur at or below 3,000 feet. Strikes at higher altitudes are common during migration. Ducks and geese are frequently observed up to 7,000 feet. March through April and August through November are listed as the prime migration periods.

The AIM notes there are four major migration routes across the U.S. with numerous other smaller flyways. The major routes are the Atlantic Flyway which parallels the Atlantic Coast, the Mississippi Flyway which includes the Great Lakes and Mississippi River areas, the Central Flyway located east of the Rocky Mountains, and the Pacific Flyway which parallels the West Coast. These routes are flown by birds traveling from Canada and the northern U.S. to the southern U.S., Mexico, and Central and South America.

When flying in and near one of the flyways, pilots should avoid flying low. If operationally possible, another suggestion you might want to consider is to fly as slowly as possible consistent with safety when flying near birds to minimize the force of a bird strike. The impact forces are both a function of the closing velocities and the weight of the bird and aircraft.

Pilots should also avoid charted wildlife refuge areas. If overflight is necessary, please comply with the minimum overflight altitude listed on the chart. If possible, you should fly at a higher altitude both to minimize disturbing the protected wildlife and to minimize the chance of a bird strike. The higher altitude also provides extra time in case of an engine failure, bird strike, etc.

DEALING WITH THE INEVITABLE

No one wants to hurt or kill a bird, but sometimes bird strikes are unavoidable. Although airport operators, aircraft operators, the military, and the FAA have spent millions of dollars and years of effort trying to solve the bird strike problem, the problem will continue as long as birds and pilots share the same airspace. But as we start a new year and as the birds wintering in the south start their annual trek north to their spring nesting areas, pilots need to be especially watchful and avoid birds and their flyways whenever possible. In the case of operating in and out of airports with known bird problems, pilots need to be very careful. In such cases, pilots should develop an emergency plan of action in case of a bird strike or engine ingestion.

In the case of an engine or engines sucking in birds during takeoff, like any takeoff emergency, the question becomes one of do you have enough power to go-around, or do you have to abort on the runway? This is the classic go-no-go decision.

A bird strike or engine ingestion while you are en route becomes a question of can you continue to an airport for a landing or must you make an off-field landing? In some reported bird strike accidents, there was control damage, but the pilots were able to continue flying. In others, especially those involving helicopters, the pilots had to make precautionary landings.

If in-flight, what are your plans if a bird strikes your windshield and penetrates your cockpit? Assuming you are uninjured, are you prepared for the noise, confusion, increased drag, and bird parts and blood in the cockpit? If the bird is not killed by the impact, what are you going to do with an injured, terrified, wild bird in the cockpit? What are you going to do if that bird is the size of a duck or goose and it lands in your lap? Or, for that matter, what are you going to do with an injured, terrified, wild passenger in the cockpit? These are only some of the questions a pilot must be prepared to answer when operating near birds.

NTSB BIRD STRIKE ACCIDENT REPORT REVIEW

A review of 67 accidents covering the period from January 1983 through April 1995 revealed some interesting data. For one thing, bird strikes or birds being ingested into jet engines can happen to any type aircraft from small, single-engine aircraft to helicopters to ag aircraft to Boeing 747's. There were 12 fatalities listed from all causes and 11 serious injuries listed in the 67 reports. The good news is the number of bird strikes that resulted in substantial aircraft damage resulted in minor or no injuries to those on the aircraft.

The key point here is how few bird-related accidents are fatal to the aircraft occupants or pilots. Of the 12 fatalities listed in the reports, one fatality was only indirectly related to the bird strike. Apparently because of a misunderstanding between the pilot and his passenger, the passenger jumped to his death after he misjudged his height above the water as the helicopter was making an emergency water landing after a bird strike.

MAINTAIN CONTROL OF YOUR AIRCRAFT

In reading the 67 accident reports, some of the pilots apparently forgot to remember the first and most basic rule of flying: Always fly your aircraft.

Even when involved in the confusion and shock of a midair cockpit bird strike, pilots must continue to fly their aircraft. The NTSB data told of accidents in which a few of the pilots took evasive action to avoid birds and either lost control of their aircraft or flew the aircraft into the ground or low wires. In some cases, the pilots lost control while taxiing, taking off, landing, or while trying to go around. In others they lost control in flight. As previously stated, one defensive technique to avoid birds is to pitch up or climb because birds normally dive to avoid danger, but if you pitch up to avoid a bird strike, you can't pitch up so high you stall. A stall/spin accident can be just as damaging as a bird strike.

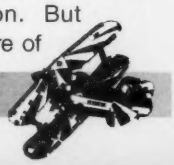
Another surprising discovery was the number of fatal and serious injury accidents reported that were the result of what could best be described unofficially as pilot error. After the bird strike or while maneuvering to avoid birds, the aircraft crashed. In a surprising number of cases, the pilot ran off the runway or taxiway or failed to execute a successful go-around or collided with an object after trying to avoid a bird or a flock of birds. In a few cases, the pilot simply lost control of the aircraft after a bird strike or while trying to avoid a flock of birds and crashed. These reported accidents show that a pilot must always fly the aircraft no matter what happens.

And fly their aircraft is exactly what the majority of the pilots did in the 67 NTSB accident briefs. Most of the pilots were able to regain or retain control and execute a successful landing at an airport or an off-airport site. In some cases, this was done while injured. In one case, the pilot suffered facial injuries and his glasses impacted his head when he was hit in the face by a bird, but the pilot was able to land in spite of his injuries wearing a spare pair of glasses. In some cases, a copilot was able to land the aircraft. In a few cases, the pilot heard a thump while flying but did not discover that the aircraft had been hit by a bird or birds until after landing when damage was discovered.

STRIKES CAN HAPPEN ANY TIME OF DAY

The NTSB reports also highlighted another important observation. Bird strikes can happen any time day or night and at various altitudes. In many cases, the strikes occurred during darkness. In other cases, the strikes occurred during daylight. In one case, an IFR pilot hit birds upon breaking out of a low overcast. In some cases, it was known that large numbers of birds were on the ground when the pilot attempted to takeoff or land.

In the case of a night bird strike while in cruise, there is little a pilot can do to avoid such a collision. But when the pilot is aware of



Graphic proof that birds and planes don't mix. The pilot of this light twin struck a Canada goose at night. Luckily he was in radar contact and communication with a military air base, where he was able to make an emergency landing. No injuries to the pilot, but fatal for the goose and a big dent in the pilot's wallet as well as windshield centerpost.

the possibility of birds on an airport or birds have been reported on the airport, a pilot must be prepared for a collision if a takeoff is attempted or a landing made while the birds are near or on the runway.

In such cases, it would appear to be wiser to delay the takeoff or landing until the birds clear the area.

If the birds are just loafing (a termed used in one government report to describe bird actions) on the runway and are not moving off, the pilot has to use good judgement in determining what to do. Contacting the tower, airport manager, or the local FBO is one solution.

The airport may have noise devices to scare the birds away or someone could drive a vehicle through the area to make the birds move, etc.

Regardless of what the airport does, it may be safer for someone on the ground to make the birds move than to try to move them in an aircraft and risk a bird strike.

If possible, the pilot might divert to another airport. Regardless, the pilot in command is responsible for the safe operation of his or her aircraft.

BIRD/WILDLIFE INFORMATION AND INCIDENT REPORTING

The appropriate FAA *Airport/Facility Directory* (A/FD) can warn pilots of potentially dangerous bird populations. Pilots flying into non-familiar airports can check the A/FD for any listings about birds/wildlife hazards. For example, the entry for New York's JFK International states, "Flocks of birds on and invof [in the vicinity of] arpt." The Washington National Airport entry says, "Flocks of birds on and invof arpt. Frequent seagull and geese and duck populations airborne over adjacent river areas." The Philadelphia International Airport entry also lists birds on and invof arpt. (Its entry also lists another common problem for many airports: deer—but that's another story.)

In its ongoing effort to compile and track operational hazards, the FAA's Office of Airport Safety and Standards has FAA Form 5200-7, Bird Strike Incident/Investigation Report, that aircraft operators and pilots can use to report such incidents. The form asks for such information as extent of damage, estimated repair costs, incident location, effect on flight, phase of flight, and information about the number and type of birds involved. It also asks if the pilot was warned of birds. The report can also be used to report other wildlife species incidents or damages. The form is included in the AIM, as Appendix 1, Bird Strike Incident/Ingestion Report. It is also available from local FAA offices and airports. According to FAA data, 2,200 civil bird strikes were reported in the U.S. in 1994.

Hopefully, no one will have to fill out a Bird Strike Incident/Ingestion report as we approach the beginning of another migratory season. Let's all keep a sharp lookout for our feathered friends.

After all, we are sharing their airspace. ✈

Editor's Note: We want to thank Mr. Chris P. Dwyer, formerly a Wildlife Biologist for the U.S. Department of Agriculture, for his suggestion that another article was needed on bird strikes and for the research material he provided for the article. Dwyer is now working with the Missouri Department of Conservation. We also want to thank the NTSB for the accident data, and the Andrews AFB Aero Club for its assistance.

• Density Altitude

There are two air safety discussions which usually omit very important considerations.

Density Altitude/Oxygen use. FAR § 91.211 states "(a) General. No person may operate a civil aircraft of U.S. registry-(1) At cabin pressure altitudes above 12,500 feet (MSL)...." It could be assumed that "cabin pressure altitude" refers to standard conditions and lapse rate. What about a day with high density altitude? Standard day oxygen levels could be reached as much as 3,000 feet lower than actual MSL. A pilot who waits to go on oxygen at 12,300 feet MSL would be breathing air of a density level of 15,300 feet.

Takeoff Density Altitude. One time while serving on a race car pit crew, we measured the temperature of the surface of a blacktop track. It was a hot day (90 degrees F) at about 2 p.m. in July. Track surface temperature registered 140 degrees F. If the weather station was recording an official temperature of 90 degrees F what was the air temperature five to 10 feet above the 140 degree pavement? Could takeoff run density altitude be considerably higher than a weather report would lead one to allow for? If the aircraft is equipped with an OAT gauge, a check on the ground would be in order.

Stuart L. Faber
Cincinnati, OH

Oxygen requirements are based only upon barometric pressure (cabin pressure). Temperature is not a factor in determining cabin or pressure altitude. The comparison with density altitude is incorrect. As noted in the Aeronautical Information Manual (AIM) page 8-1-2, FAR § 91.211 specifies as a minimum that flight crews use supplemental oxygen after 30 minutes of exposure to cabin pressure altitudes between 12,500 and 14,000 feet and immediately on exposure to cabin pressure altitudes above 14,000 feet. It notes every occupant of the aircraft must be provided with supplemental oxygen at cabin pressure altitudes above 15,000 feet.

Having stated the FAR requirements, the AIM recommends that pilots use supplemental oxygen above 10,000 feet during the day and above 5,000 feet at night for optimum protection against hypoxia. The AIM notes the hypoxia a pilot experiences at altitude is because of the reduced barometric pressure at altitude, not because of less oxygen. The percentage of oxygen in the atmosphere remains about 21 percent throughout the atmosphere. The problem is the reduction in differential pressure between the various gases in the atmosphere and a pilot's lungs which result in the lungs being less able to absorb enough oxygen.

To be safe, pilots may want to use oxygen whenever they fly at altitude. The AIM also notes important ways for pilots to reduce their risk of hypoxia, i.e., reducing your exposure to carbon monoxide from either smoking cigarettes or breathing exhaust fumes and avoiding certain kinds of drugs and alcohol. Check the AIM for a complete listing.

Regarding your comment about surface temperature and density altitude. You are right: All pilots should check the density altitude at their location before takeoff on hot days. Conditions could be different at the end of a long runway. A lot also depends upon what type of material was used to make the runway. A black, asphalt runway may be hotter than a concrete one. As you said, when in doubt, every pilot should check the conditions at the takeoff end of the runway.

• Kudos

Once in a while one finds superior work. It is so seldom that I cannot go on without telling you and your staff how much I appreciate the publication. It has vital data, and in general, in my opinion, it is the best of all publications today, without exception. I would like to see the commercial ones do a bit less in ads and a bit more in good information, such as you have.

It is well rounded, and I might mention, you folks have come a long way from 20 years ago.

Thomas E. Doyle, Attorney
Oakland, MD

Thank you for the compliment. Please remember, commercial magazines depend upon advertising revenue to pay their bills. Overall, they do a pretty good job of balancing the needs of their accountants with the needs of their readers.

• If You Think That's High!

I often get a chuckle when reading about the problems with takeoffs at say Leadville, CO, which is a mere 9,927 feet MSL.

May I suggest a real problem—a takeoff from LaPaz, Bolivia—at 13,404 feet MSL.

Russell Hoyt
Rockville, MD

Kinda makes you want to get out the ol' E6B computer to check the density altitude. But even on a standard day, LaPaz is about at the service ceiling of many small GA aircraft.

• Crosswind Formula

Editor's Note: The following letter was sent to the "Old Cap'n" concerning his article in the April 1995 issue.

Dear Old Cap'n, I spent my last vacation at Clearwater Beach, FL, where I learned that *FAA Aviation News* offers a lot of interesting topics.

So, I read your advice referring to crosswind landing on Page 20 and 21 more than once. But calculating the approach speed has lead me to a kind of confusion for the following reason. The first example states, Approach speed: One point three times Vso. One hundred thirty percent of your stall speed in the landing configuration. If your aircraft stalls at 38 knots, you'll fly your approach at about 50 knots. That makes sense to me since 38 knots times 1.3 equals 50 knots.

But the second example states, "If 1.3Vso equals 61, your approach speed would be about 80." In this case you add another 30 percent, so it is Approach Speed equals (1.3Vso) times 1.3, or 61 knots times 1.3 equals 80 knots. In this example, it is calculated not by Vso, but by 1.3Vso. So what is the reason for the difference?

Peter Karge
Berlin, Germany

A mistake was made in typing the second example. The formula used in the first example is correct. The rule for finding approach speed is Vso times 1.3 equals the recommended approach speed. The second example should have said, "If Vso equals 61, your approach speed would be about 80."

Thanks for pointing out the mistake. The Old Cap'n tips his cap to you for your keen eye. You are the first person to write about the mistake.

• Part 61 Changes

The September 1995 FlightFORUM had a question about the second-class medical requirement for FAR Part 141 flight school graduates to take the instrument rating flight test. The response included a statement that the requirement would be removed in a revision "...to FAR Part 61 due for release later this year...." Can you be more precise as to the release date?

Gregory E. Maynard
via e-mail

No. The Notice of Proposed Rulemaking (NPRM) on the numerous changes to FAR Part 61 was detailed in the October issue of FAA Aviation News. *A date for the final rule has not yet been established, since there will be a volume of comments on the proposed rule changes to be evaluated.*

FAA Aviation News *will keep readers apprised of the progress of one of the most massive regulatory rewrites in FAA history.*

• Photo ID

To relatively new pilots such as myself, it may be helpful and informative to caption more of the photographs used in the magazine, such as the make and model of aircraft depicted.

Capt. George S. Mycroft
Lutz, FL

We will do our best. In some cases, we don't always have or receive complete captioning information.

• Alcohol Levels

I would like to turn your attention to an error in the March 1995 issue of the *FAA Aviation News*. In the article "Alcohol and Flying...." (MedicalStuff Dept., pp. 18 and 19), a footnote in Table 2 wrongly states that the legal limit for alcohol (0.08-0.1%) means 80-100 mg of alcohol per ml of blood. It should be 80-100 mg per 100 ml (or 80-100 mg per dl).

Your article and the quiz are excellent reminders to all pilots to lay off the "booze."

Dr. Kazimir Sestanj
Monmouth Junction, NJ

Thanks for your correction.

• Healthy Eating

As both a private pilot and a registered dietitian, I wish to thank you for the November-December 1994 article "Flight Crews Should Monitor Cholesterol Levels Closely." I always appreciate positive focus on nutritional considerations that promote health and quality of life.

However, the editor's note to this article regarding a holiday meal, Thanksgiving dinner, with 27 grams of fat as illustrated by 27 tablespoons of shortening is misleading. The typical Thanksgiving meal probably contains even more than 27 grams of fat, depending of course, on the type and amount of foods consumed. Fat may realistically total 85 or more grams. Five grams of fat equals about one teaspoon of solid fat such as shortening. Therefore, 85 grams of fat would equal about 17 teaspoons of solid fat, or about five and a half tablespoons. This amount is not anywhere near the 27 tablespoons described, but is still an excessive amount in one meal.

A lower fat intake is achieved by omitting or reducing consumption of the obvious fats such as margarine and butter, as well as the not so obvious fat in sauces, gravies, nuts, chips, and rich breads and pastries. They are all types of foods consumed during the holidays.

Dietary fat reduction over time is accomplished through small daily changes such as switching from whole milk to low-fat or skim milk, substituting non-fat plain yogurt for sour cream, and even switching to the new non-fat forms of mayonnaise, sour cream, and cream cheese. Such low-fat fare is not only healthy, but tasty too.

Sandy J. Wickham, M.A., R.D.
Pagosa Springs, CO

The image of the 27 tablespoons of shortening was only symbolic. Your comments at this time of year give us all hope of recovering from the holidays. By following your recommendations, we can all start eating our way towards a healthier new year.

NASA Recognizes ASRS Program Office Manager

Battelle Corporation of Columbus, OH, has announced that Loren J. Rosenthal, vice president and program manager at Battelle, has been awarded the Ames Honor Award by NASA for 14 years of service to the national Aviation Safety Reporting System (ASRS) program. Rosenthal is the program manager for the ASRS program office in Mountain View, CA.

The award nomination states in part that, "Mr. Rosenthal is an exemplary support-service contractor. He brings great credit to the NASA Ames Research Center as well as to Battelle."

ASRS is a voluntary Aviation Safety Reporting program developed by the FAA and operated and managed by NASA to provide everyone in aviation with an anonymous means of reporting safety problems with aircraft operations, air traffic control procedures, communication problems, airport operations, and near midair's. Depending upon circumstances, certain disciplinary actions against persons who file timely ASRS reports may be waived in cases involving certain unsafe incidents.

The FAA Aeronautical Information Manual (AIM) and Advisory Circular (AC) 00-46, Aviation Safety Reporting Program provides additional ASRS program information.

ASRS is designed to increase aviation safety through the timely reporting of unsafe operations and procedures.

1995 CFI/AMT of the Year Winners

The winners of the 1995 Flight Instructor and Aviation Maintenance Technician of the Year Award are Evelyn A. Carlson of Sunrise Aviation and David Walter Thissell of Northeast Aircraft Maintenance Corporation, respectively.

The CFI/AMT of the Year awards recognize outstanding contributions to the general aviation industry by an active maintenance technician and flight instructor. Through national recognition of the important role maintenance technicians and flight instructors play in aviation safety and pilot education, industry and public attention is focused on the vital contributions made by CFI's and AMT's. The program was sponsored by the FAA, the AOPA Air Safety Foundation, the General Aviation Manufacturers Association, the National Air Transportation Association, the National Business Aircraft Association, the National Association of Flight Instructors, and the Professional Aviation Maintenance Association.

The process involves being selected as winners in the CFI and AMT's local Flight Standards District Office jurisdiction then winning at the regional level. Each of the nine regions then submits one CFI and one AMT name to a national committee, which makes the final selection. Applicants are judged on the basis of specific accomplishments and sustained superior performance in their fields.

David Walter Thissell has been an aircraft maintenance technician for more than 30 years. As part of his commitment to the aviation industry, Thissell has provided a free ground school segment on aircraft maintenance topics for students of Alpha One Flight School, as well as offering numerous seminars for the Aviation Safety Program covering preventive maintenance topics for pilots. Thissell is also a long-standing member of the Plymouth Aero Club and in that capacity has supported the Plymouth Airport "Fun Day," an annual event in Massachusetts which aims to facilitate good relations between the flying public and the surrounding community. Thissell has also been the recipient of the Plymouth Aero Club "Airman of the Year" award. One colleague noted in a nomination form, "He has a genuine respect for aviation, enough to do the job right the first time—no exceptions."

Evelyn "Lyn" Carlson has long been recognized for her dedication to her profession and training expertise that has ensured safer and more highly skilled pilots at every level. Carlson has been the mentor of many a struggling pilot who has learned from her knowledge, her ability to explain complex ideas in concrete ways, and the sincerity and genuine interest she takes in her students. Carlson teaches ground school, counsels practicing flight instructors at Sunrise Aviation in California, is an accomplished administrator, and continues to fly with and instruct students on multiple levels. She also teaches aviation meteorology at Orange Coast College and presents safety meetings for the FAA. One recommender stated, "Her diverse background and experience with the Peace Corps have combined to create a sophisticated educator with a keen eye for observing and assisting the student in learning."

Thissell and Carlson received numerous honoraria from industry organizations, including cash and training courses from national training schools. Their awards were presented by FAA Administrator David R. Hinson during a special luncheon at the 1995 AOPA Convention in Atlantic City, NJ. For information on the 1996 CFI/AMT of the Year Awards, contact the Safety Program Manager at your local Flight Standards District Office.

Photo Clarification

In our October 1995 issue we did an article in our FAA/Education series on Central Missouri State University, illustrated with photographs supplied by the author and CMSU. On page 18, we ran one of an airplane landing with several students standing on or near the runway. The caption indicated that CMSU was Region VI precision flight champs and that a member of the team was honing skills during a precision landing practice. What the caption did not say was that two of the students near the runway were observers/judges. The others—including the young woman sitting on the runway—were other team

members who were spectators but *who had no business being that close to a runway during flight operations.*

Wow, did we get letters, and, wow, did we deserve them. It was a last-minute, space-filling, and absolutely poor choice of a photo, an even poorer choice of caption, and the responsibility is entirely mine. Thanks to those who pointed out that we were depicting a potentially unsafe act, and we offer an apology to our readers.—The Editor

OLYMPIC GAMES TEMPORARY FLIGHT RESTRICTIONS

Although not generally well known, the 1996 Summer Olympic Games are not all going to be held in the Atlanta, GA, area. There are a total of 12 different aeronautical charts that will depict some of the temporary flight restriction (TFR) areas associated with the different game locations.

The first charts in chronological order that will show the TFR's are as follows.

Effective 2/1/96:

Charlotte Sectional --
Olympic Village (Savannah)
Sail Harbor & Wilmington River Transit Zone

Effective 2/29/96:

Baltimore-Washington TAC
Baltimore-Washington Flyway --
RFK Stadium

Jacksonville Sectional
Orlando TAC --
The Citrus Bowl

Miami Sectional,
Miami TAC
Miami Flyway --
The Orange Bowl

Effective 3/28/96:
Atlanta Sectional --
Olympic Village (Atlanta)
Olympic Ring
Wolf Creek Skeet Range
Stone Mountain Park
Atlanta Beach
International Horsepark
Lake Sidney Lanier
Sanford Stadium
Golden Park
Lee College
U.S. Highway 64
Ocoee River
Legion Field
Olympic Village (Savannah)
Sail Harbor & Wilmington River Transit Zone

Atlanta TAC
Atlanta Flyway
Olympic Village (Atlanta)
Olympic Ring
Wolf Creek Skeet Range
Stone Mountain Park
Atlanta Beach
International Horsepark

Atlanta Helicopter Route Chart
All of TAC & Flyway venues plus Lake Sidney Lanier

GA on an Upward Turn

According to a General Aviation Manufacturers Association (GAMA) press release, third quarter general aviation aircraft shipments and billings continue to improve. GAMA President Edward W. Stimpson was quoted as saying, "All indications point to positive recovery for general aviation manufacturers."

He continued by saying, "For well over a decade, general aviation in the United States had been in serious decline. But, as a result of Congressional efforts last year related to product liability, the industry is recovering and companies are investing in the future."

GAMA reported aircraft shipments increased 23 percent in the third quarter 1995 compared to the same quarter in 1994. The third quarter 1995 saw 257 aircraft shipped totaling $648.9 million. This was an increase of 34.1 percent compared to $484 million shipped in the third quarter of 1994. Total piston-engine aircraft shipped during the third quarter 1995 were 138 aircraft. This compares to only 107 shipped during the third quarter 1994. Exports also were up during the third quarter 1995 with 79 units shipped compared to 56 units in 1994. The value of the 1995 third quarter export units totaled $217 million.

Compared to 1994, 1995 year to date shipments for piston aircraft increased by 16.2 percent, turboprop shipments increased by 19.3 percent, and jet shipments increased by 11.6 percent. Total year to date shipments increased by 15.8 percent compared to the same 1994 period.

NPRM Deadline Extended

If you haven't had a chance to comment on the Notice of Proposed Rulemaking for Federal Aviation Regulations Parts 61, 141, and 143, good news. The deadline for comments has been extended until February 13, 1996.

To obtain a copy of this NPRM contact the FAA Public Inquiry Center, APA-220, 800 Independence Ave., SW, Washington, DC 20591 or by calling (202) 267-3484 and ask for Docket No. 25910 or NPRM Number 95-11 that was published in the Federal Register on August 11, 1995.

Compuserve members may obtain a copy of this NPRM by obtaining it from Library 15 of the AVSIG Forum by downloading the file called NOT_9511.ZIP. Also a copy may be obtained from FedWorld by dialing 703.321.3339, going to the FAA Data Library and downloading the file and called NOT_9511.LZH.

Comments should be sent in triplicate and marked "Docket No. 25910" to FAA Office of the Chief Counsel, Attn: Rules Docket (AGC-10), Docket No. 25910, 800 Independence Ave., SW, Washington, DC 20591.

Reinstatement of Hoover Medical

On October 18, 1995 the FAA granted noted aviator Robert "Bob" Hoover a restricted second-class medical certificate, allowing the aerobatic pilot to resume performing at air shows in the U.S. In addition, Mr. Hoover has been granted full, third-class privileges, allowing him to fly as a private pilot.

Since December 1993, Mr. Hoover has been unable to pilot aircraft under FAA rules because of a medical condition determined by the agency to be disqualifying under its medical standards.

The FAA has always been willing to reconsider airmen for medical certification whenever there was a reason to believe that the circumstances that prompted the denial of such certification may have changed. Such is the case with Mr. Hoover. It has been more than two years since the FAA revoked Mr. Hoover's unrestricted medical certificate. The results of new tests conducted this summer and evaluated by outside medical specialists have led the FAA to conclude that Mr. Hoover's condition has stabilized. In light of this, it is appropriate to grant Mr. Hoover a restricted second-class medical certificate that will enable him to resume his air show performances but under more medical scrutiny than would be required of an airman with an unrestricted second-class medical certificate.

While holders of unrestricted medical certificates are required to take medical tests at least every two years, under his restricted certificate Mr. Hoover will be required to be tested annually, and his tests will be more comprehensive.

USPA Reaches Membership Milestone

Lori Mathews, 19, of Suffolk, VA, gathered her parachute after a stand-up landing at Skydive Suffolk on September 28, 1995. Her jump ended the ceremony officially welcoming her as the 30,000th member of the United States Parachute Association (USPA). Women make up about 15 percent of USPA's membership.

Founded in 1946, USPA is an internationally-recognized parachuting membership organization dedicated to safety, certification of skydivers and skydiving instructors, and represents U.S. skydiving interests to all levels of government including the Federal Aviation Administration.

In 1991, USPA reached the 20,000-member mark after 45 years but took only four years to add 10,000 more members. The current growth rate is about 1,000 new members a month.

USPA was featured in the January-February 1994 *FAA Aviation News* Special Series: FAA and Industry.

FAA Air Traffic Manager Selected for AOPA Air Safety Foundation Award

AOPA Air Safety Foundation executive director Bruce Landsberg, right, presents ASF's Distinguished Service Award to "Hal" Becker.

AOPA Air Safety Foundation Photo

Harold Becker (Hal), Manager, FAA Airspace Rules and Aeronautical Information Division, was presented the AOPA Air Safety Foundation's (ASF) Distinguished Service Award last October 20 at the Aircraft Owners and Pilots Association convention held in Atlantic City, NJ.

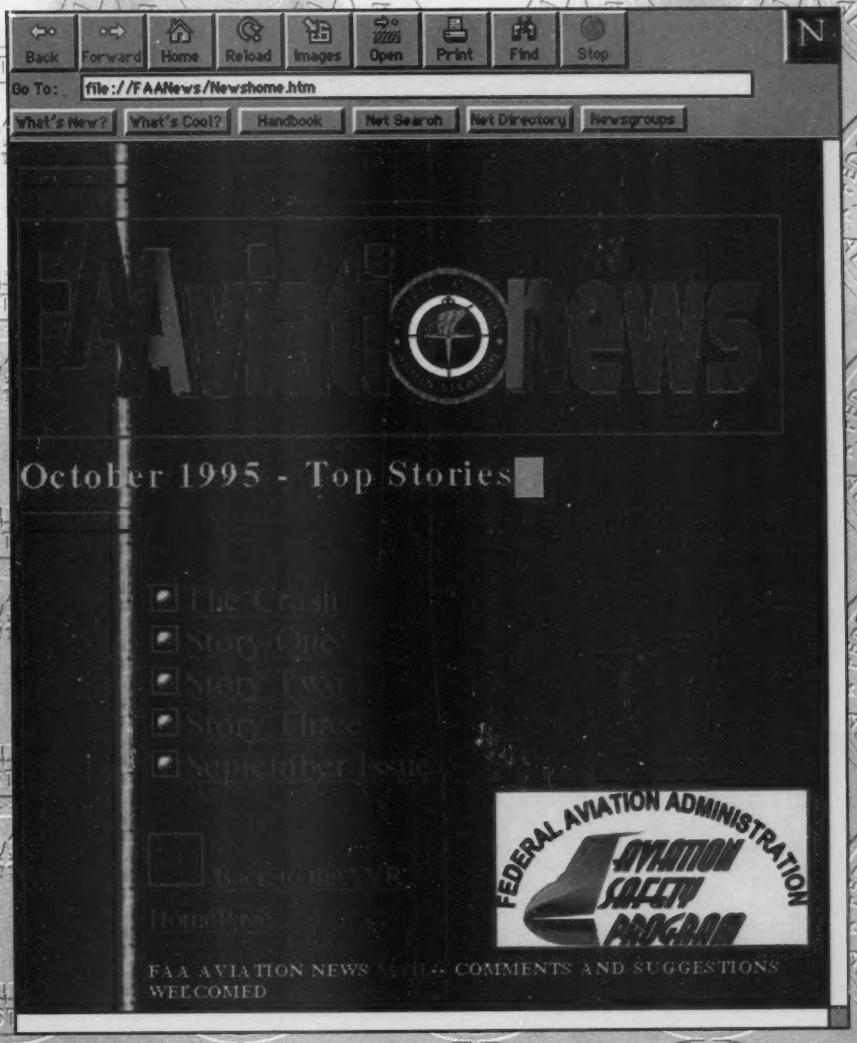
ASF Executive Director Bruce Landsberg said, "Hal Becker is an FAA person who understands general aviation. He supports the cause of air safety and, in fact, has been an unsung but key factor in many important programs for general aviation."

In addition to his position within Air Traffic's senior executive service, Becker owns and flies his own Cessna 172. He is a commercial, instrument-rated, single and multiengine pilot with flight and ground instructor privileges. He is also a glider pilot.

When asked about his award, Hal said, "I am honored to be the recipient of this award."

He said that he sincerely appreciated the assistance he and the FAA have received from the AOPA Safety Foundation on safety matters and pilot education and that he would strive to continue their excellent working relationship.

You're invited...
To visit us on the Web!



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Phyllis-Anne Duncan, Editor

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